Railway Mechanical Engineer

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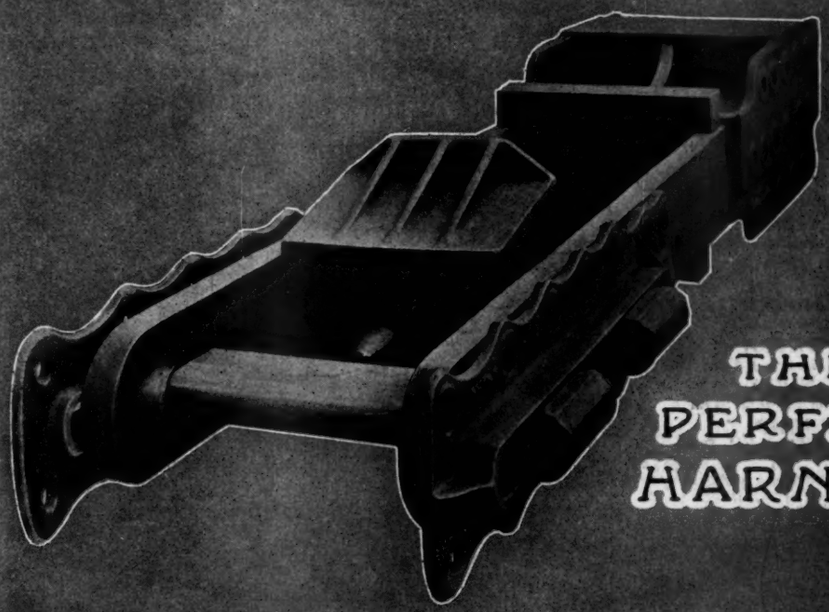

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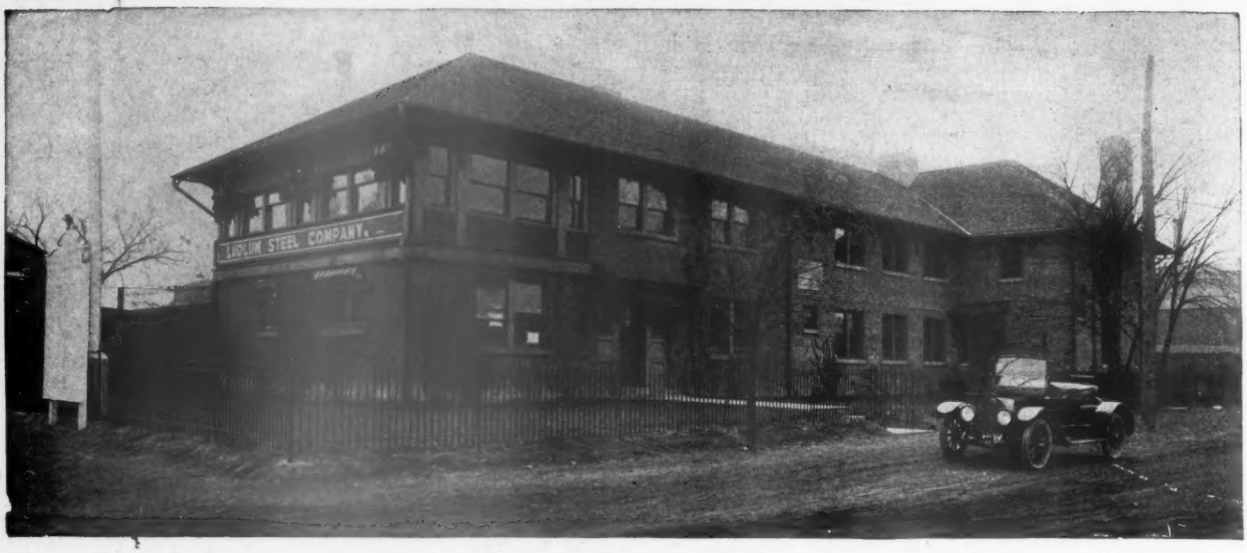

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The Fuel Crisis

With the status of rates established and the wage controversy settled, the fuel problem remains the one thorn in the side of the railroads that promises to harass them relentlessly throughout the coming winter. It is a grave situation when many railroads are not getting sufficient coal to meet current requirements at a time when it is customary to stock for the coming winter, and it is a serious matter when any railroad has to pay over $20 a ton for locomotive coal. It is time that every mechanical employee took a renewed interest in reducing the fuel bill and in making it possible for his railroad to operate next winter without cutting off many trains from the schedule. Fuel is the pulse of the railroad; almost every operation in the conduct of the railroad, almost every physical feature in its make-up affects directly or indirectly the size of the coal bill. Of those factors which directly affect coal consumption, the condition of the locomotive is of outstanding importance. Mechanical engineers can do many things that will help save coal. One of these is to provide a joint for the outside steam pipes where these intersect the smokebox so that this connection can be kept free from air leaks, as described in an article on this subject appearing in this issue. New locomotives should be built with joints that can be kept tight, old locomotives should be provided with such joints as fast as they go through the shop. The foreman's duty with respect to saving coal is obvious; he is expected and should be required to keep the engines under his jurisdiction in the best condition possible with the facilities at his disposal. Details count for everything in this game and of these none is more important than nozzle size. Only the strictest supervision will eliminate nozzles that are needlessly restricted for one cause or another. Engineers frequently prefer reduced nozzles to insure plenty of steam under all conditions and nozzles reduced are seldom enlarged to an economical diameter, once the cause has been removed. If the roads expect enginemen to do their bit toward saving coal, they must neglect no detail in the upkeep of the locomotive that will make for efficiency.

Do Clothes Make the Foreman?

Some years ago a superintendent of motive power strolling through an important engine terminal spoke of a certain foreman for whom he originally had a high regard. When the man first tackled the job he wore overalls and a jumper. "Now," remarked the superintendent of motive power, "I see that he has discarded the overalls," and added laconically, "When he discards the jumper I think I will have to let him go." Perhaps the superintendent of motive power knew from the way things were going that the foreman was losing his grip on the job and accepted his habit of dress merely as an indication. On the other hand, would the superintendent of motive power have been justified in accepting this incident as proof that the foreman was not making good? It has been alleged that some well-known corporation magnates would judge a man by the clothes he wore. If the young business man must wear good clothes to make an impression and get ahead in the world, must the railroad foreman wear old clothes or a suit of overalls to "stand in" with the superintendent of motive power? It is well enough to say that the matter of dress is at best a superficial question, but many men take the subject quite seriously. These men feel that their character of dress will not only make an impression on their superiors, but will affect the relationship with the men under their supervision.

The man who wears overalls or his oldest and most grease-

stained suit in order to make an impression on the superintendent is no more deserving of criticism than the man who believes that a silk shirt and neatly creased trousers will command greater respect from the men who are obliged to go about in dirty overalls. The railroad shop or roundhouse is no place to display your particular preference for green or red neckwear, plain or striped hose, and so on; nor is it the foreman's place to banish modest self-respect and grovel in dingy garb in order to make it appear that he has just emerged from the inspection pit when, as a matter of fact, he has been comfortably lounging in the foreman's office. It is suggested that in view of the present high cost of living the shop is a good place to wear out the suit that your wife objects to having you wear downtown. It is further suggested that a moderate display of white linen sets well on any foreman, not so much as a matter of personal taste or even self-respect, but as an indication of the fact that you have your work well organized, that you do not find it necessary to personally inspect every bolt and rivet—in fact, that you are using your head as well as your arms and legs.

No Cause for Complaint

The railroad labor organizations profess to be dissatisfied with the award of the Labor Board which granted an increase of 13 cents an hour to the shop crafts. The principal argument advanced by the unions to support their claims for higher wage scales was the advance in the cost of living. It is therefore interesting to analyze the award from that viewpoint. The cost of living at present is variously estimated to be 100 to 115 per cent higher than in 1914. The statistics of the Interstate Commerce Commission for that year are incomplete, but they show that the average daily compensation of machinists in railroad service was $3.27 and of carpenters $2.66. The present rates for an eight-hour day are $6.80 for machinists and $6.48 for car men, making the increases 108 per cent and 144 per cent, respectively. However, in 1914 many shops were working 10 hours instead of eight and all overtime is included in the wage given in the commission's report, so the actual percentage of increase is greater than shown above.

The statistics for 1915 are more complete and while they include some advances in wages over 1914, they furnish an interesting basis for comparison. The average hourly wages of mechanics in 1915 were as follows: machinists $0.386, boilermakers $0.386, blacksmiths $0.371, car inspectors $0.232, car repairers $0.265 and mechanics' helpers and apprentices $0.226. The present rates, therefore, represent increases in the hourly wage of 120 per cent for mechanics and boilermakers and slightly more for blacksmiths. Helpers now receive 174 per cent more than in 1914, while car repairers and car inspectors have had increases of 202 per cent and 245 per cent, respectively. If the numerous differentials for special service were included these increases would be still greater.

The labor organizations have contended that the employees should receive increases proportionate to the increase in the cost of living, even though the hours of work were reduced. This rule has not been applied to the compensation of other classes and cannot be put in force generally until the effects of the world war are overcome and productivity of labor is increased. The unions have demanded preferred treatment and have received it. There is no basis for the claim that justice has not been done. There are always malcontents in any organization, but the majority of the shopmen are satisfied with the new award, and if the labor organizations try to stir up discontent the roads should combat it by giving publicity to the facts of the case.

The Small Power Plant

It may be recalled that in July the *Railway Mechanical Engineer* commented editorially on the modernization of stationary power plants and referred inadvertently to an article dealing with the installation of superheaters as a means for increasing the efficiency and capacity of the small boiler plant. The article referred to, as written by the assistant engineer of an eastern railroad, appears in this issue and is well worth the attention of mechanical men who are struggling with the problem of getting sufficient power out of the small, antiquated and overloaded power plants that may be found on almost any railroad. If it were practical to add immediately to the stationary boiler plant wherever new boilers are required, the problem would be a simple one indeed. But mechanical men are confronted with the problem of getting results with the means at hand. A change in the grade of coal furnished to the power plant will sometimes work a great improvement and where two or three grades of coal are being received on the railroad it may be possible to select a character of fuel that is more suitable than that in use. Where this can be done, the co-operation of the transportation department should be solicited with a view to having this switched to the overloaded power plant, and if necessary, cars containing this particular grade of coal should be tagged for power plant use, at the junction point where received or in the freight yard where classified.

The *Railway Mechanical Engineer* hopes to publish in an early issue a description of means undertaken on a southern railway to relieve an overloaded boiler plant, where oil fuel was substituted for coal with the result that it was possible to generate sufficient steam without additional boiler equipment. While the installation of superheaters in the stationary power plant as described in this issue involves a greater initial expense than either of the expedients above referred to, the fact that it improves the efficiency as well as the capacity of the power plant should not be overlooked. In this instance the superheaters provided additional power for much less than the cost of the equivalent in new boilers. Where additional boilers would have increased coal consumption the superheaters have reduced it.

Rehabilitate the Wooden Box Cars

One of the most gratifying items in the report of the special committee of the Association of Railway Executives recommending the distribution of about $184,000,000 of the $300,000,000 loan fund created by the Transportation Act, is the proposal of loans totaling $7,062,053 to apply on addition and betterment to 12,616 cars and locomotives. This equipment, now unsuitable for economical service, can be made available for effective use for a smaller expenditure of money, labor and material than an equivalent amount of new equipment can be provided, in a much shorter time.

Of these 12,616 units, 10,675 are box cars. But this number is far short of the possibilities for rehabilitating old box cars. There are probably more than 100,000 box cars of all-wood construction still in service the greater proportion of which are fit subjects for reinforcement. These cars, with wood draft sills, inadequate draft gears and many of them with weak trucks, do not provide adequate protection to the commodities which they themselves carry and are a constant menace to the safety of train operation. They are the cause of frequent delay to train movement and their maintenance requires an amount of labor and material entirely disproportionate to the actual service they render.

Most of these cars would have been retired during the past five years had pre-war conditions been uninterrupted. But to retire more than a small percentage of them now

would cripple the resources of the railroads for the handling of grain and general merchandise. On the other hand, to continue them in service in their present condition is exceedingly wasteful. The only logical course is to rebuild and reinforce them. This can probably be done for about one-third the cost of an equivalent amount of new equipment and they will cease to be a factor in the maintenance problem for the next four or five years. An added life averaging 10 years would justify the required expenditure and the saving in maintenance during the three or four years it will be necessary to defer retirement whether they are reinforced or not, adds materially to the attractiveness of the proposition.

The material required for the betterment of these cars can be supplied to take care of more of this work than is now under way. The car departments of every road having even a small number of these cars should consider carefully the possibilities of their rehabilitation and get approval of a plan for carrying out the work. With a program once adopted, it should be carried out as fast as the cars can be put through the shops.

An Object Lesson From Abroad

English locomotives cannot be considered impressive from the standpoint of size, weight or tractive power in comparison with American locomotives, nor does there appear to be anything strikingly novel in their construction in view of the fact that British practice is certainly more conventional than our own. However, the impression one receives from the study of a new English locomotive is that the design is the result of the most thorough study and painstaking attention to detail. There is nothing hit-or-miss about the English locomotives. They are usually designed for a specialized service and meet the requirements of that service to a nicety. The best evidence of this may be found in the initial trial trips that are usually undertaken upon the completion of a new English locomotive. The fact that such tests are not customary in this country by no means proves that locomotive development is not on a very high plane here. American manufacturers have done an immense amount of research work, the results of which are at the disposal of the railroads, and American railroads as a whole have had the good judgment to follow the lead of the relatively few roads that have been in a position to do pioneer work on locomotive development. It is doubtful if the spirit of co-operation with respect to mechanical development manifested between railroads in this country is equally characteristic of other countries. However, in this country it is generally taken for granted that a new locomotive is developing the maximum tractive effort specified, that the valves are set just right and that the reverse gear does not creep, that passages between the dome and steam chest are ample and that the locomotive can develop a high degree of superheat. In other words, the locomotive is assumed to be one hundred per cent perfect for the service for which it is designed until reports from various sources, some of which are decidedly non-technical, either tend to confirm or to contradict this assumption. If the locomotive "makes good," that is usually sufficient, although this may be due to the fact that the locomotive has an unsuspected margin of capacity and does not necessarily prove that every part is functioning properly and that its performance could not be further improved by an adjustment or correction in design. The case of the locomotive that does not fulfill the requirements is different. These engines are generally tested but not always as rigidly as they should be, although sometimes the fault is located by a careful test in which the builder usually co-operates. The time will come when specifications on which locomotives are purchased will stipulate that capacity and efficiency be demonstrated under test conditions.

COMMUNICATIONS

STEAM GATHERING PIPE AS A SUBSTITUTE FOR STEAM DOME

DALLAS, TEX.

TO THE EDITOR:

The comments in your editorial (page 256 of the May, 1920, issue) suggest the use of a steam gathering pipe perforated on its top side and extending along the barrel for some distance. The area of the perforations should be in excess of the area through the throttle valve when fully open. This device permits the steam from a much larger volume of steam space than is possible with any steam dome. The liability of water entraining with the steam is thus reduced very considerably. The engines built in the last few years on the Great Western Railway of England have no domes at all, but use a perforated pipe, and engineers have told me that they can carry water from three to four inches higher on these engines than with boilers fitted with domes. I have also seen perforated pipes used in stationary boilers in New Zealand to prevent water being carried over to the engines and the results were quite satisfactory.

P. D. ANDERSON.

SHALL CRAFT UNIONS REPRESENT THE FOREMEN

NEW YORK.

TO THE EDITOR:

Early in June there was issued from the headquarters of the Federated Shop Crafts a circular regarding certain petitions for wage increases which had been presented to the Labor Board and stating that these included adjustments and improved working conditions for foremen. This circular directed that a campaign be instituted to bring all supervisors below the rank of general foreman into the craft organizations, "using every legal means toward that end." The desire for power is inherent in human nature; and as the original field of activities for craft unions had been well covered, an attempt to enlarge this field if possible was natural. The next step would be to control supervision.

The shop foreman, as a rule, has risen from the ranks of labor, has often been a union man, or friendly to organized labor. Previous to government control he too often was denied working conditions and compensation in proportion to his duties and responsibilities, his subordinates often receiving more than he did. These conditions inevitably led to the conviction in the minds of foremen that in organization lay the only means by which they could obtain a square deal and resulted in many foremen joining the craft unions.

In different sections of the country, however, supervisors were brooding over their condition, with the result that they came to the conclusion that their only salvation lay in a supervisors' organization. This gave rise to two organizations, both working toward the same end but with conflicting opinions on some points, rendering it impossible heretofore to unite the two bodies. Consequently foremen are divided into four groups, those belonging to no organization, those allied with the craft unions and the members of the two competitive bodies.

The crafts are antagonistic to the idea of a supervisors' organization for obvious reasons and a definite compaign to suppress this movement and coerce foremen into membership of the craft unions did not come unexpectedly. The question now arising is, what should be the foreman's attitude toward membership in the craft unions? The writer, a shop foreman, offers the following opinions with reasons annexed as the feeling of himself and his immediate associates:

Three elements are necessary for the effective conduct and promotion of business—capital, labor and management. Capital supplies the money to run the business, labor does the work, while the function of management is the employment of capital and the direction of labor in conducting the business. Management is the keystone in the arch of business.

The duties of the foreman are distinctly those of management. He employs, disciplines and dismisses labor directly or by recommendation. He plans and directs the operations entrusted to him. He uses capital when ordering supplies and signing time slips, virtually signing his name to a check on the treasury. He is responsible for the maintenance of the tools and property under his care and carries out the agreements with labor as to wages and working conditions. He also recommends improvements and change in policies, and guards the wellbeing of the employees under his charge.

The duties of the foreman of a half a dozen sweepers are the same on a small scale as those of the general manager; the same principles governing both. The fact that a mechanic may be as able and intelligent as his foreman does not enter into the question. Their duties, conditions of employment, and viewpoints are different and must always be so.

A letter from the Director General shortly before the return of the railroads to private control expressly stated that foremen were officers. Detailed instructions on this basis were issued as to foremen's working conditions.

The functions of a railroad are different from those of ordinary business in that the public grants special privileges, such as the right of condemnation of private property, in order that the railroad may be properly constructed and equipped for operation. These privileges are granted with the understanding that transportation so vital to the public will be maintained, making the railroad a public utility and placing its management a direct obligation to the public.

The man who accepts the position, salary and perquisites of a foreman also shares the responsibilities of the management, one of which is to maintain transportation at all times and under all conditions. While this may be true of the workman as well as of the foreman the workman is not responsible for the operation of the railroad and the foreman should not obligate himself to be guided by the wishes of any body of men who for any reason may undertake to interrupt transportation.

If the power of organized labor could be so extended as to include everyone up to the general manager and a strike of all ordered, one could scarcely imagine what the result would be. Yet this is the principle involved when the union undertake to control the "bosses."

We hear a great deal now about industrial democracy, which means giving labor a voice in the management. It is possible that at some future time this principle can be applied to railroads, but it will not relieve the management of its responsibility when, if ever, this time comes. Any attempt by a craft organization to legislate for foremen without their authority is unwarranted.

The question now arises as to how the foreman can protect himself from injury resulting from his refusal to be dominated by organized labor, and also to maintain good working conditions, just compensation and the security of his position. As organization is beneficial to capital, and as labor is endlessly proclaiming this privilege, it is but logical that management avail itself of this right. The problems of the yardmaster, roadmaster, station agent, and all those having immediate direction of labor are similar and could be handled by one association, but whether this plan is adopted or these occupations have separate organizations federated, they should be of, by, and for supervision that their problems may be handled befitting their station.

At this time, when all railroad management is working under depressing conditions, the assurance that, no matter what has happened heretofore, no supervising officer will ever again be compelled to work for less compensation than his subordinates, that his position shall be respected, and his working conditions maintained in keeping with that position, will do much to influence him to stay with the railroads, do his best and refuse to be dominated by organized labor.

Harold C. Prentice.

New York.

EDITORIAL ON WELDING BRINGS REPLY

To the Editor

The editorial in the July issue of the *Railway Mechanical Engineer* entitled, "The Status of Autogenous Welding," points out that the railroads accepted this process as a cure-all during the early developments of the art and states there is grave danger of the re-action now going too far the other way. It is very necessary to have the work properly laid out and prepared; moreover, much depends on the skill of the operator; more than most of us realize. A careful check must be made of the welds each operator is making and the best way is to have in the supervisory forces of the road a man who devotes all his time to looking after welding. On small roads where there is hardly enough welding work done to warrant one man devoting all his time to welding work, a systematic check of welds can be made without much inconvenience on the part of the foreman in charge, by having the operators make test specimens at frequent intervals. The simple process of breaking these specimens will show if the operator is making a good weld; that is, if the metal is thoroughly united. If proper facilities are available, pulling the test specimens on a tensile machine is a much better check. A record should be kept of each check made of the operator's work and while the fact that test specimens show up well does not guarantee that other welding work will be as strong, it will go a long ways towards insuring good welds.

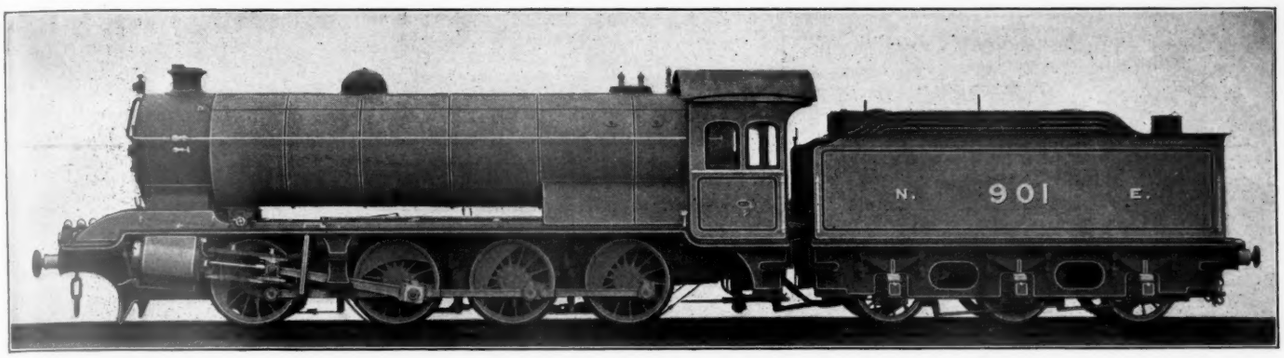
Some roads that have gone into firebox repairs by autogenous welding have been enabled to lengthen out firebox life as much as 100 per cent. Side sheet renewals are being made on boilers of types that absolutely prohibit the riveting process. Patches are being successfully welded in back flue sheets at practically all locations in the sheet. The money saving involved is so much that it will pay any road to have its supervisory forces spend sufficient time to check the operator's work. Almost any method would really be warranted that would keep the autogenous process of doing boiler work in use in preference to going back to the old methods.

One of the things that has had a lot to do with the present re-action on this subject is the over-enthusiasm that was displayed on the welding of small boiler tubes to back flue sheets. Occasional leakage of tubes is eliminated by welding but a number of roads have welded tubes in engines, particularly where water conditions are not good, with disastrous results. In bad water districts, or in localities where there is quite a scale formation on the tubes and flues immediately adjacent to the tube sheet, much trouble has been experienced with welding small tubes. The tube either develops longitudinal cracks after a few months' service or the bridges in the tube sheet crack.

That scale formation causes these troubles has not been proven conclusively, although scale deposit has a tendency to prevent the water from properly cooling the sheet. The theory is that using the prosser expander reworking unwelded flues loosens this scale so that it may be washed out.

If a locomotive will give reasonable mileage with small tubes unwelded, there is no particular point in welding them as there is grave danger of bringing about attending troubles that are much worse than occasional tube leakage. The art of electric welding is still in its infancy in spite of the fact that there have been wonderful developments made during the last few years. It certainly would be unfortunate if the re-action was to result in the railroads neglecting the art.

General Foreman.



North Eastern Mineral Hauling Locomotive

NORTH EASTERN BUILDS MINERAL LOCOMOTIVES

These Engines Typify English Designs and with a Tractive Effort of 37,000 lb. are Relatively Powerful

BY ROBERT E. THAYER
European Editor of the *Railway Mechanical Engineer*

THE North Eastern railway has recently built and placed in service some of the most powerful freight engines used in Great Britain. These engines were built in the company's shops at Darlington, to the designs of Sir Vincent Raven, the chief mechanical engineer of that road. They are classified as mineral locomotives of the T.3 type having an 0-8-0 wheel arrangement. These engines are to be used in the coal traffic in the Newcastle district and are designed to haul a load of 1,400 metric tons (1,543 short tons) on a 0.5 per cent grade. They have three simple cylinders 18½ in. by 26 in. They weigh 160,380 lb. in working order, the total weight of the engine and tender being 259,200 lb. They have 55¼ in. drivers, carry a boiler pressure of 180 lb. and have a rated tractive effort of 36,960 lb.

These engines are considered powerful for English practice. They are built very nearly to the clearance limitations of the North Eastern. The width over cylinders is 8 ft. 9 in. which is 3 in. less than the minimum clearance width

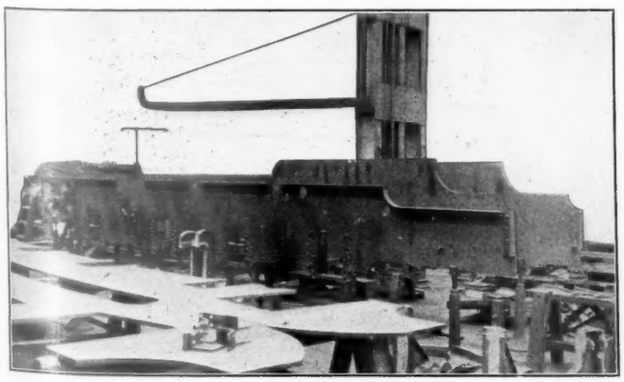


Fig. 2—Plate Frame for North Eastern Mineral Locomotives in Process of Construction

and the top of the stack is 13 ft. 1 in. above the rail which is 5 in. less than the minimum height clearance. The general arrangement drawing is shown in Fig 1 (page 506).

These engines were given a dynamometer test with a train consisting of a dynamometer car, 60 loaded coal cars and a brake van or caboose having a total load of 1,402 long tons. This train was tested over a 60 mile section having a ruling grade for a short distance of 0.57 per cent. The contour of the line is such that there is a steady pull to the summit of the grade. The maximum drawbar horsepower developed in these tests exceeded 1,100 d.h.p. On the test trip running in the opposite direction there is a ruling grade of 0.93 per cent for about 4 miles. The train in this direction consisted of the dynamometer car, 60 loaded freight cars and a guard's van which gave 787 long tons as the total weight of the train. During this test the train was stopped on the ruling grade and a start was made with a drawbar-pull of 28,000 lb. and the speed was increased to 16 m. p. h. in seven minutes after starting.

These locomotives are equipped with the Schmidt superheater, brick arches, steam reverse gear, force-feed lubricators to the cylinders, the Lockyer double-beat throttle valve and exhaust steam injectors.

Following is given a brief description of these locomotives together with a description of some of the practices followed in their construction.

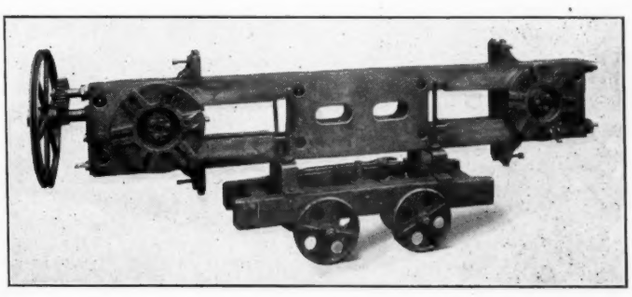


Fig. 3—Horn Facing Machine for Finishing Pedestal Jaws

Construction Details

These engines following the customary British practice are equipped with plate frames which are 1⅛ in. thick, 3 ft. 7½ in. deep between pedestals and 2 ft. 1½ in. deep over the pedestals, being spaced 4 ft. apart. These frames are shown in the process of erection in Fig. 2. No system of

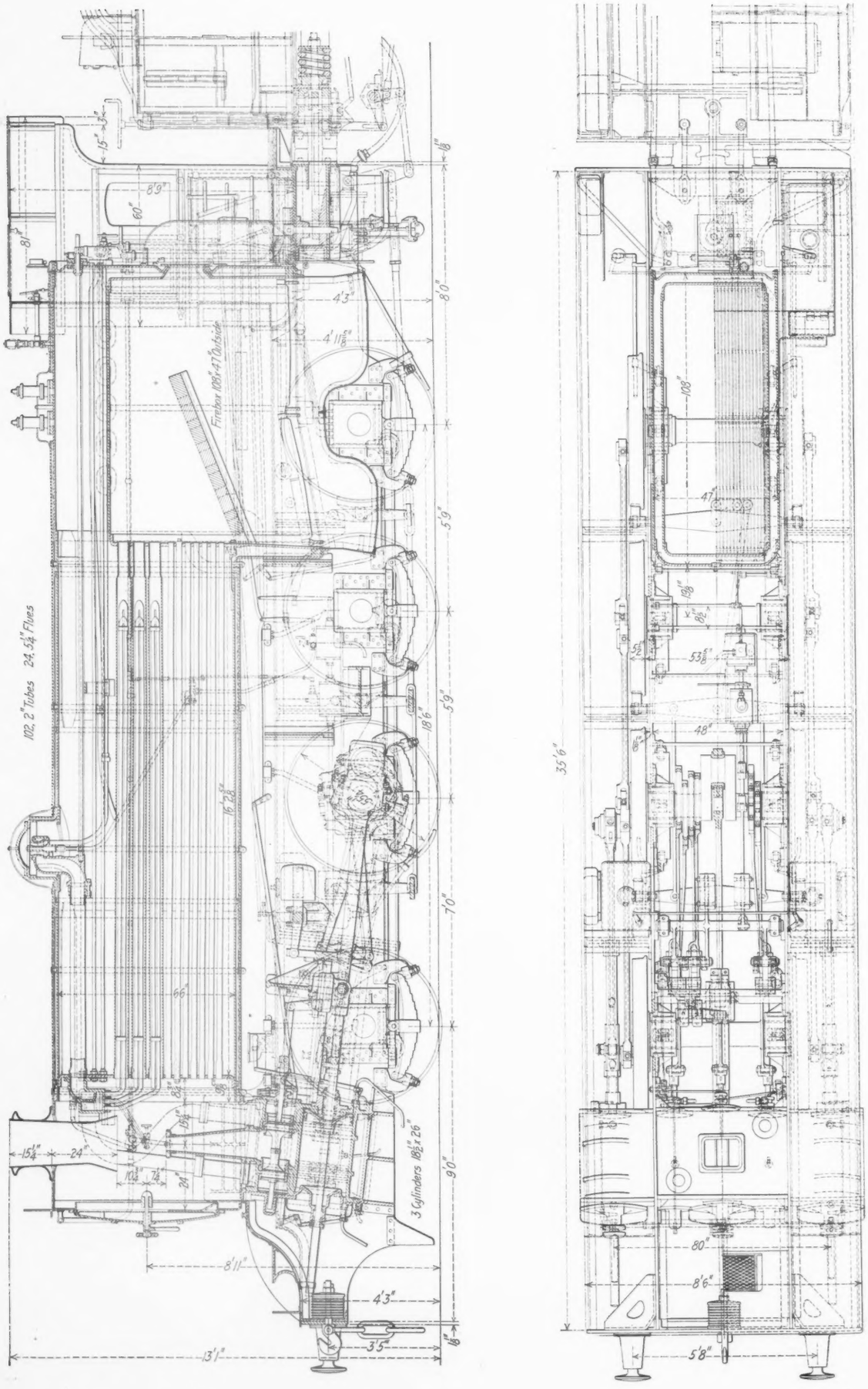


Fig. 1—General Arrangement of the North Eastern Mineral Locomotives

equalization is provided on these locomotives and the heaviest axle load is carried on the first pair of drivers which amounts to about 41,000 lb. No shoes or wedges are used on these engines as a careful machine fit is made between the driving box and the pedestals. The pedestal jaws are faced with a special device known as the horn facing machine, a picture of which is shown in Fig. 3. This is a portable device and its method of application is indicated in Fig. 4 which shows a repair engine having its pedestals refaced. With this machine an accurate surface in the pedestal jaws is obtained, the degree of accuracy being indicated by a clearance limitation of .008 in. between the driving box and the pedestal faces of the leading drivers and a clearance of 0.13 in. between the driving box and the pedestal for the axle under the firebox. An additional clearance is given to this driving box on account of its proximity to the firebox where an allowance must be made for expansion of the parts.

The driving boxes are lubricated from oil cups attached to the frames. Two lubricating pipes pass from each cup to each of the leading boxes and five to the rear driving boxes. Additional lubrication is required in this case on account of the heat to which the driving box is subjected from its proximity to the firebox. Force-feed lubrication is provided for the valves and cylinders, the force-feed lubricator being placed just above the leading axle on the frames and deriving its motion from a system of levers coupled to the inside valve rod. One interesting feature in the construction of this engine, in fact all engines built in these shops, is the fact that the cylinders, which in this particular case are all in one casting, are mounted on a dummy frame and the cross heads and other motion work are placed in proper alinement. A view of this dummy frame is shown in Fig. 5. It will be seen that there is plenty of space to get at the various parts which greatly facilitates the work.

This fitting having been carefully done these parts can be mounted directly onto the frame of the locomotive without additional adjustment. In a like manner the valve motion links are adjusted on the link truing table preparatory to their being applied to the locomotive and thus effecting a considerable saving in time.

This locomotive having three cylinders requires the cranked axle which in this particular case is of the solid type, although the built-up type is used to some extent on this road. The rods drive on the second axle and Fig. 6 shows this axle with the wheels mounted and after the eccentrics and the driving boxes applied. The cylinders which are shown in Fig. 7 are cast in one piece. They are bored on a special machine (Fig. 8) which was designed especially for three cylinder work and which permits all three cylinders, and by special attachments, the valves also, to be bored at one time. The valves used in these engines are shown in Fig. 9.

Boiler

No less care is taken in the construction of the boiler than in the construction of the rest of the locomotive. A drawing of the boiler is shown in Fig. 11. It is made up of three

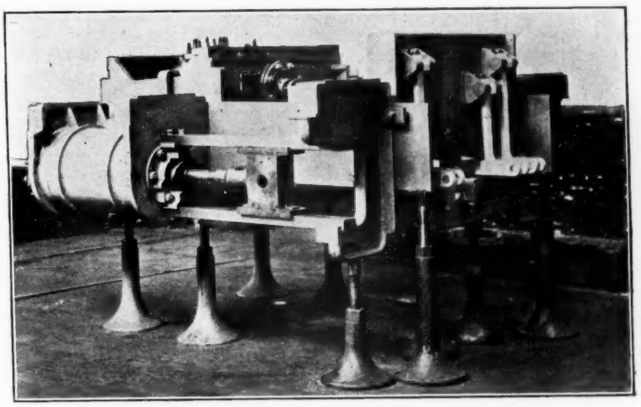


Fig. 5—Rear View of Dummy Frame

parallel rings of 66 in. outside diameter. The barrel plates are 5/8 in. thick, the front tube sheet 7/8 in. thick, the wrapper sheet 5/8 in. thick and a back head of 5/8 in. The firebox is made of copper, the roof and side sheets being made of one piece and being 5/8 in. thick. The tube sheet is 1-3/16 in. thick, being narrowed down to 5/8 in. thick at the throat

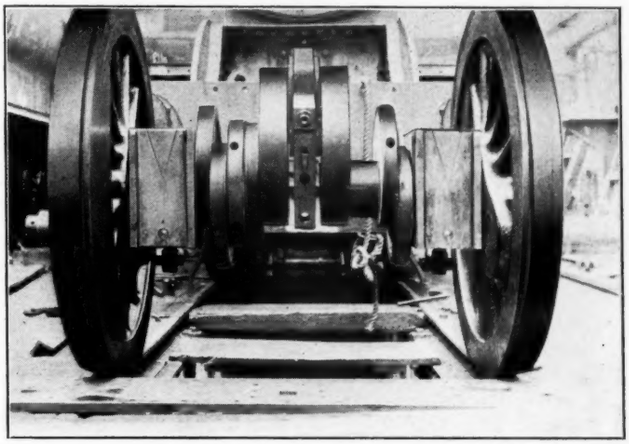


Fig. 6—Cranked Axle Ready for Application to the Locomotive

This boiler has 102, 2-in. tubes and 24, 5 1/4 in. superheater flues and 7 stay-tubes. The distance between tube sheets is 16 ft. 2 5/8 in. Through these stay-tubes pass stay-rods of 1 in.

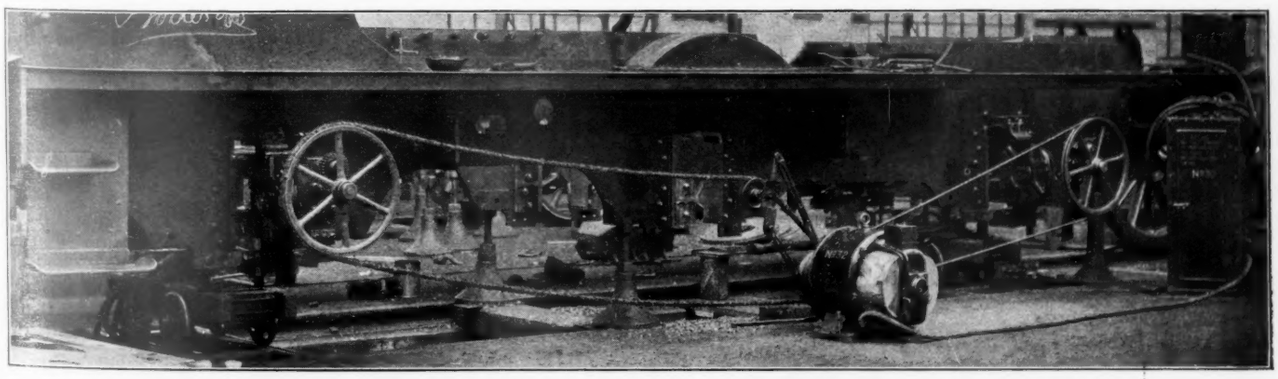


Fig. 4—Horn Facing Machine Applied to Repair Engine

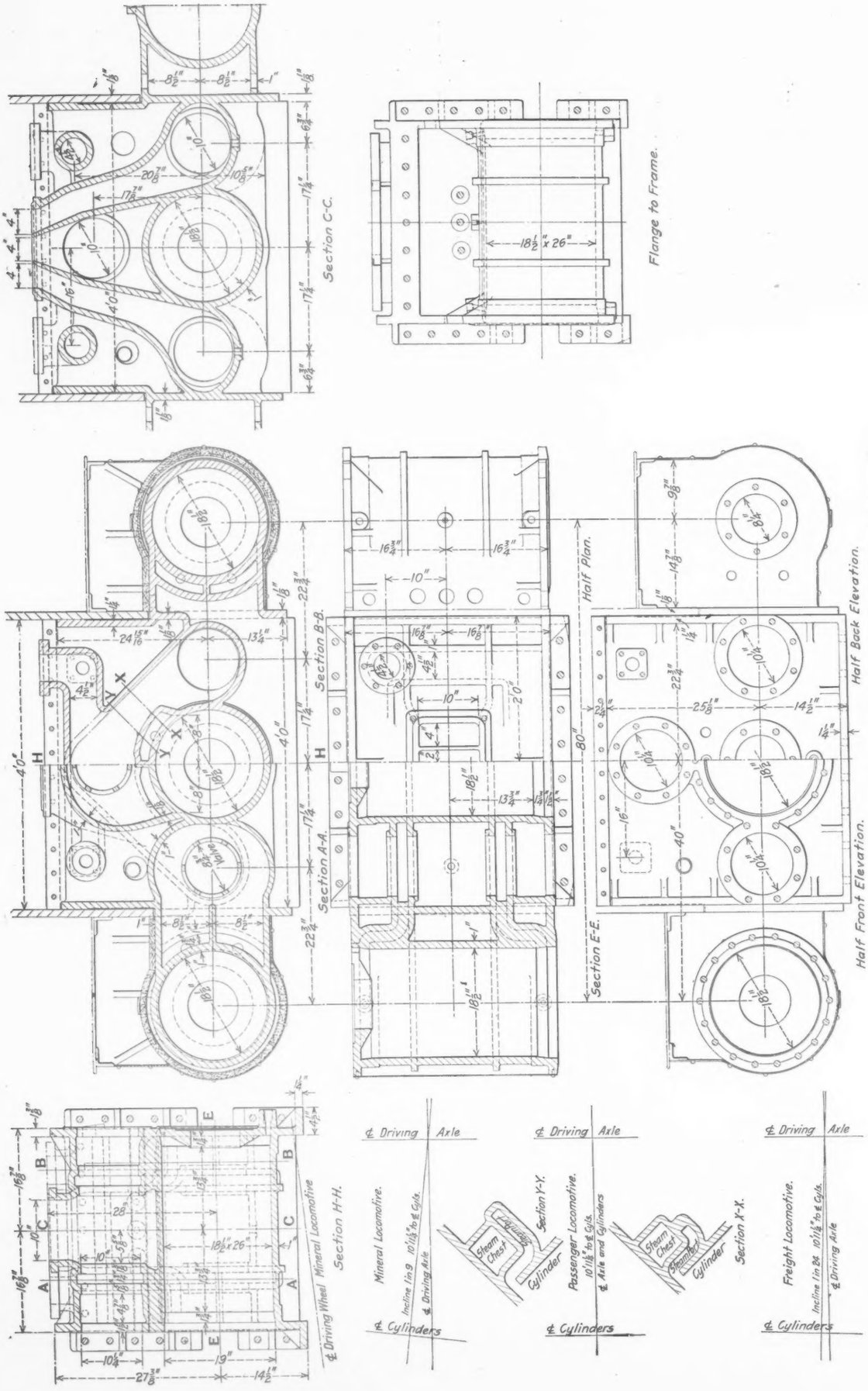


Fig. 7—Cylinders for North Eastern Three-Cylinder Mineral Locomotives

diameter which are held by cap nuts at the tube sheets. These are shown in the boiler drawing.

Contrary to a very general practice used in England and also on the North Eastern whereby an angle ring is used on the front end of the boiler to which is riveted the barrel

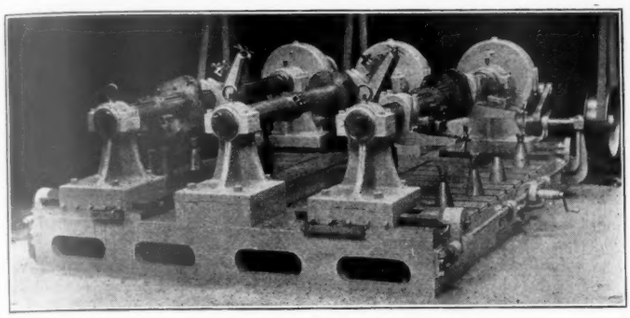


Fig. 8—Machine for Boring Cylinder Castings

and the front tube sheet, as indicated on the left hand of the boiler barrel shown in Fig. 11, the front tube sheet of this boiler is flanged and riveted directly to the boiler barrel. The back head is flanged on its periphery to provide for riveting it to the firebox wrapper sheet from the outside. Likewise a similar joint is made with the copper back sheet of the firebox and the back head at the door. This is not common practice in England, a door ring being the customary form of construction.

It will be noted from the boiler drawing that the barrel courses are butt riveted on the circumferential seam. This practice is common throughout the English railways. After the barrel sheets have been trimmed and rolled they are held by straps of scrap iron bolted into "tack" holes which are drilled in the sheets before they are rolled. All three courses being treated in the same manner the process of assembling is as follows: The middle or dome course is placed end up on the floor. The circumferential welt plate, being bored to a diameter ⅛ in. less than the outside diameter of the boiler barrel, is heated to a cherry red and placed over the upper end of the dome course and held in position by tack bolts. The third barrel ring is then fitted into place by means of an overhead crane and is also held in place by tack bolts. The welt is thus shrunk on to the barrel sheets. (It should be mentioned, in passing, that the only holes drilled in these sheets and the welt strips are those necessary for holding them together with tack bolts. These holes are of a smaller diameter than the rivets and are redrilled as explained later.) With the second and third courses thus united the same process is carried through in applying the circumferential welt to the first and second courses.

After both rings have been put in place and securely fastened, and the longitudinal welt strips "tacked" in place, the boiler is taken to a boiler barrel drilling machine which is shown in Fig. 11. All rivet holes both for the longitudinal and circumferential seams are then drilled in this machine. This is done to obtain a true radial rivet hole and one that will exactly match in the welt strips and plate thus making any drifting unnecessary. After all the rivet holes have been drilled the longitudinal welt strips are removed and the surfaces of the boiler and welt strip thoroughly cleaned. Every hole is then slightly countersunk with a pneumatic

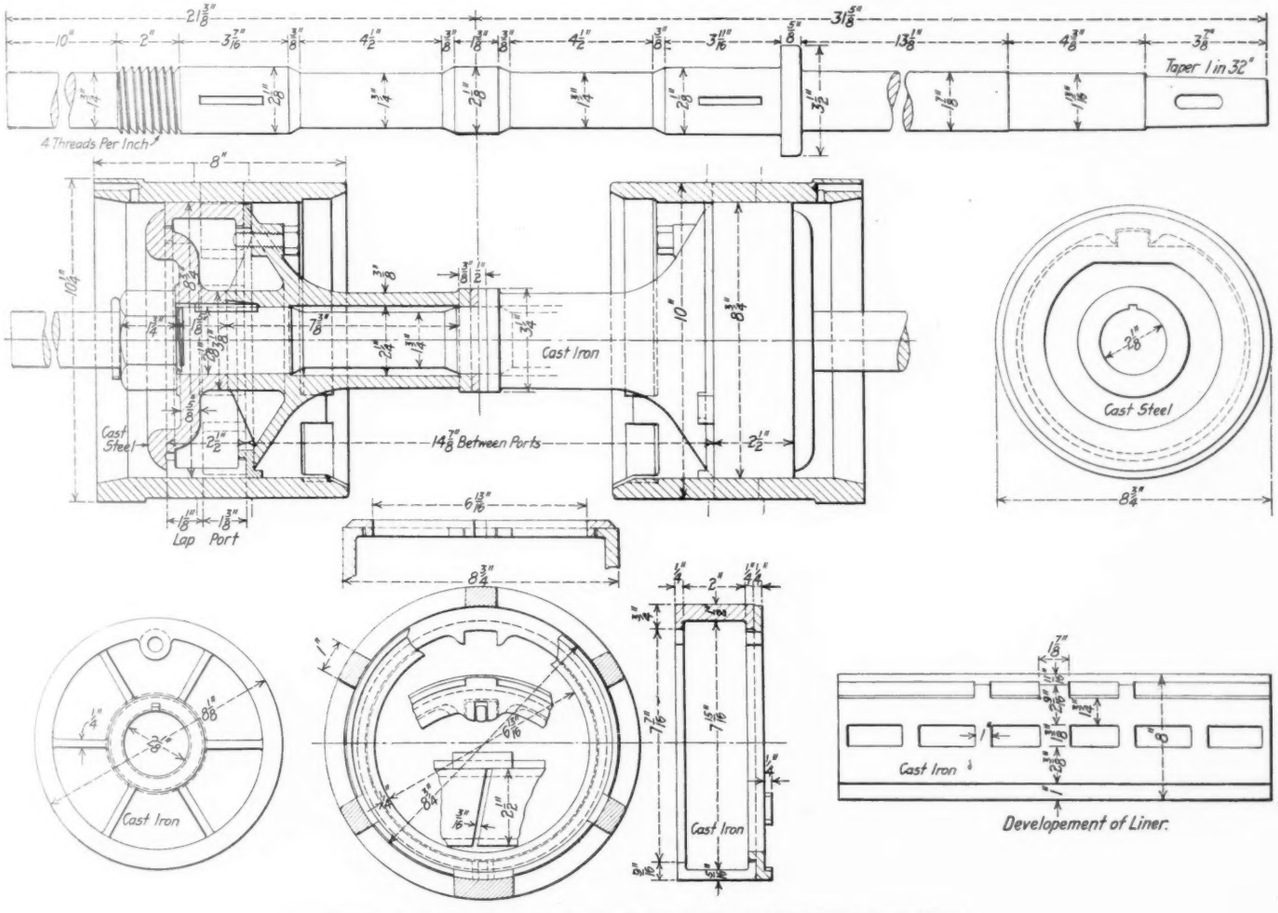


Fig. 9—Piston Valves for North Eastern Three-Cylinder Locomotives

rotary machine. The butt straps are again replaced and the boiler is ready for riveting in a bull riveter.

The rivet and staybolt holes in the firebox wrapper sheets and copper roof and side sheets are drilled on the flat to slightly less than the ultimate diameter, four or five sheets being drilled at a time with, of course, the top sheet being the only one "laid out." The sheets are then rolled to between them to represent the water space. These plates are clamped together and the rivet holes through the two sheets drilled. The copper back firebox sheet is then taken to a machine and the door-hole machined out. Copper staybolts are used for the firebox. These are cut off to give a 7/16 in. stay head in the copper sheet and ⅜ in. head in the steel outside sheet. A long stroke pneumatic hammer

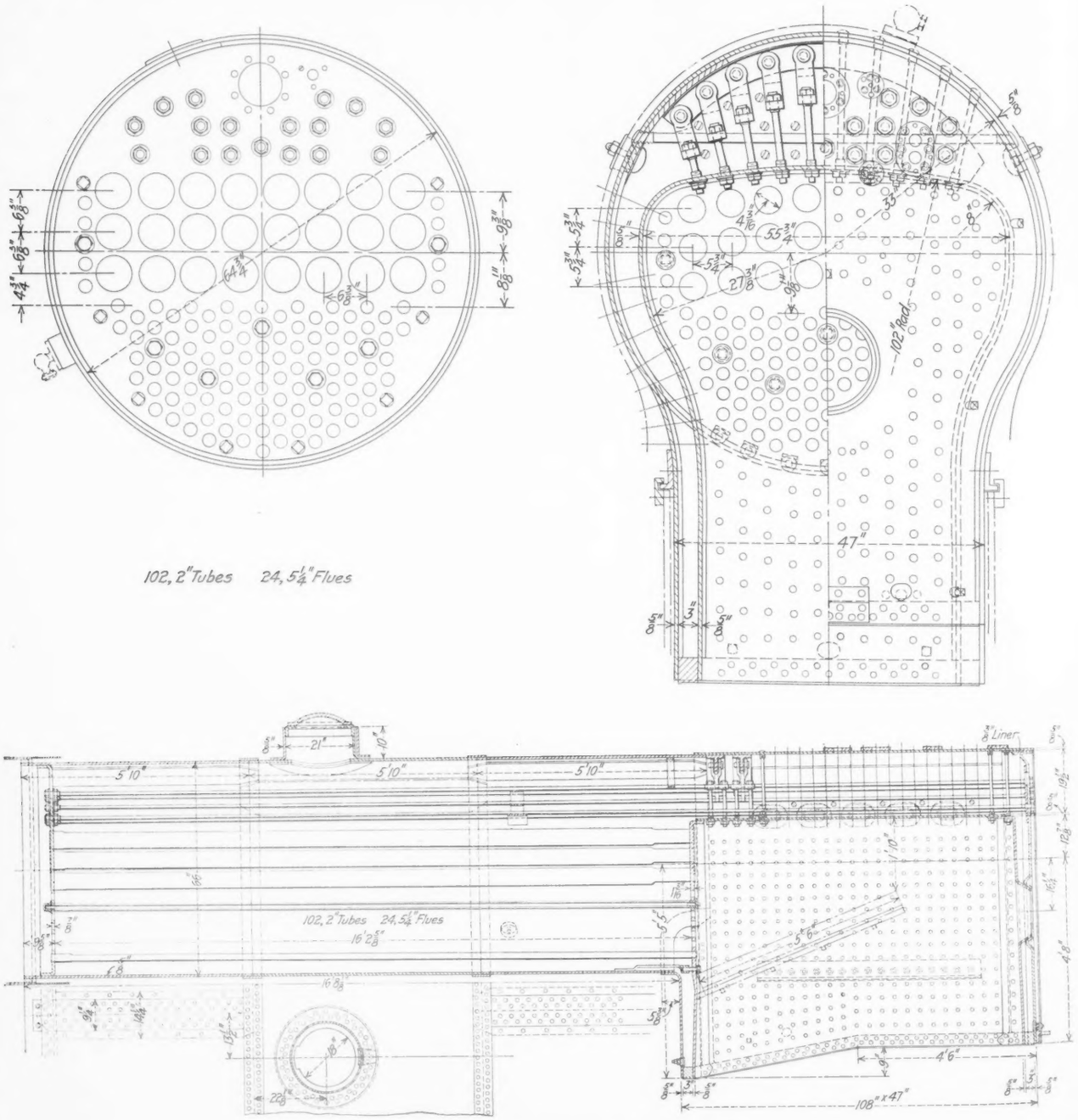


Fig. 10—Boiler Drawing for North Eastern Locomotives

shape and after they are assembled, the rivet and staybolt holes are reamed out to the proper size.

All of the copper sheets are flanged by hand with the exception of the door-hole in the back firebox sheet which is done in a press. All the steel flange work is done in the hydraulic presses. After the back firebox sheet and the back head have been flanged and trimmed they are carefully fitted together at the door hole, distance pieces being placed with a pneumatic holder-on is used in riveting the stay bolts. The foundation ring, which in this case is 3 in. by 4 in., is machined on the outside and on the inside corners. In cases where steel fireboxes are used it is machined on both inside and outside.

While a large number of English roads use the ferrules between the tubes and the tube sheet, it is not the practice on the North Eastern. The tubes extend through the copper

tube sheet 3/8 in., for beading, and about 1/2 in. through the front tube sheet. The tubes are rolled by a three roller expander driven by a pneumatic portable machine and are beaded on the firebox end only, with the exception of the stay tubes which are beaded on both ends. The ends of the superheater flues extending through the firebox tube sheet are machined on the outside and care is taken to prevent any scale or foreign matter from working in between the sheet and the flue. These flues are then expanded by a special five roller expander and beaded as in the case of the small tubes.

The North Eastern has a particularly well equipped boiler shop which is of sufficient capacity to more than take care of the needs of the road.

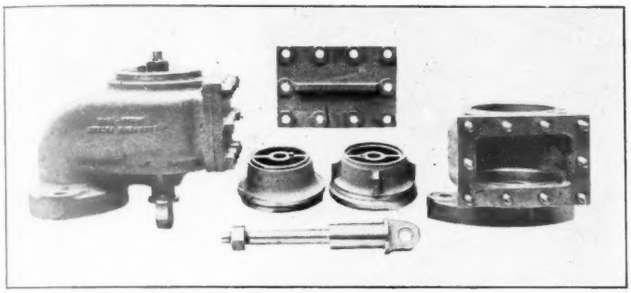


Fig. 12—Lockyer Double Beat Valve Showing Assembled Valve and Separate Parts

Special Attachments

Among the attachments to this locomotive may be mentioned the "Lockyer" double-beat throttle valve, designed by N. C. Lockyer, the works manager at Darlington. This is shown in Figs. 12 and 13. The purpose of this valve is to obtain a more nearly balanced valve than is possible with the ordinary construction of double seated valve. In order to do this it has been necessary to split the valve body into two parts as indicated in the drawing and illustration. The joint between these two parts is a carefully made steam tight fit. In this particular case the diameter of the upper and lower valve seats are exactly the same, being 6 1/8 in. This, of course, could not be obtained with the valve in one piece as it would be impossible to place the valve in position. This is overcome in the "Lockyer" valve by passing the lower portion of the valve through the opening at the right of the throttle pipe casting and putting the upper part through the top of the casting in the customary way, the two

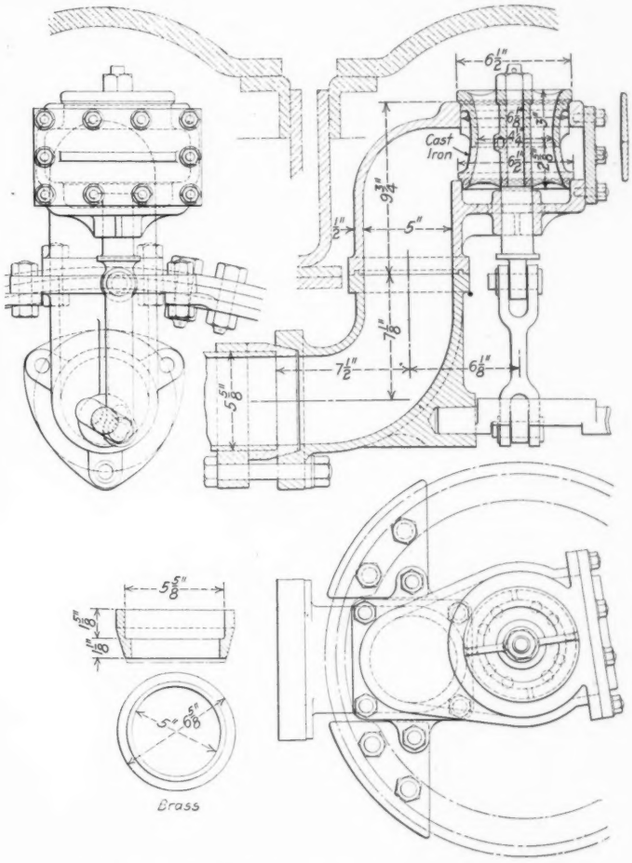


Fig. 13—Lockyer Throttle Valve for North Eastern Locomotives

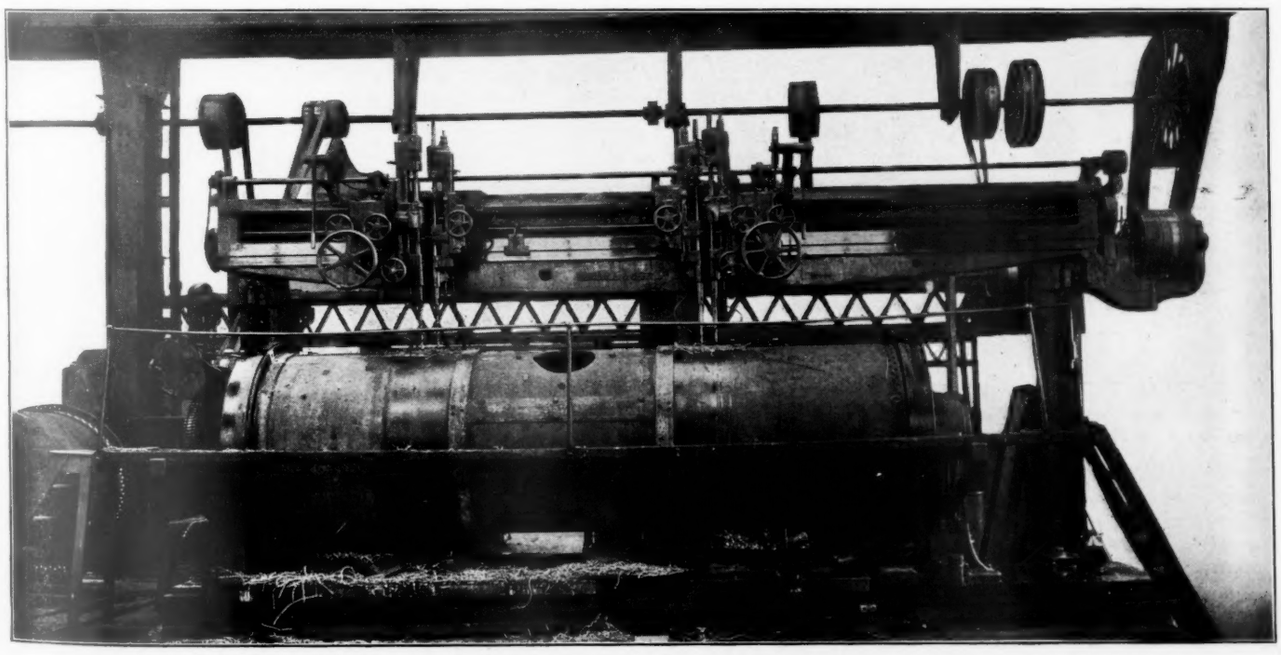


Fig. 11—Boiler Barrel Drilling Machine

parts fitting snugly to each other. They are bolted in position on a spindle. This construction permits of any combination of valve diameters desired.

It will be noted from the drawing that the upper valve has a conical baffle whereas the lower valve has a straight cylindrical base. This provides a gradual flow of steam into the dry pipe when the throttle is opened. There is an indicator placed on the throttle handle in the back head (Fig. 14) which gives the engineer indication of the throttle opening. The action of the baffles is such that the different positions of the throttle quadrant provide a steam area according to the following table:

Division of quadrant	Total area open to steam, square inches	Division of quadrant	Total area open to steam, square inches
1	0.00	7	7.74
2	0.54	8	10.62
3	1.08	9	13.32
4	1.62	10	16.38
5	2.83	11	19.98
6	5.22		

These engines are also equipped with a steam reversing mechanism which is indicated in the general arrangement drawing. The steam cylinders for operating the gear are located between the second and third drivers underneath the

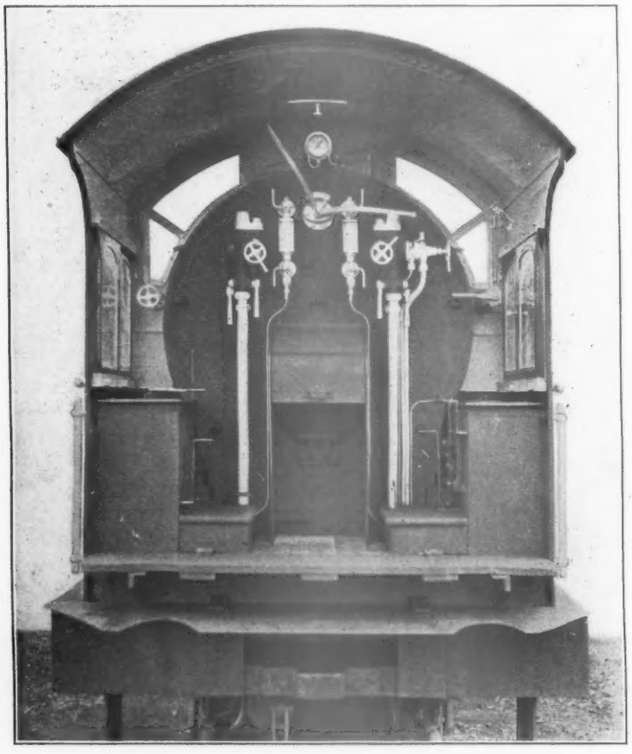


Fig. 14—Cab of North Eastern Mineral Locomotive

locomotive. The steam cylinder takes steam from the dome through a valve on the right hand side of the engine which is operated from the horizontal handle shown at the right of the cab in Fig. 14. This handle is attached to a rod, passing through the handrail, which is coupled to the control valve by a system of levers. The piston of the reversing mechanism is connected through a system of levers to an indicator in the cab which is shown indistinctly on the right hand side of the boiler head. The back head arrangement is characteristic of British practice.

General Dimensions

These engines are the latest to be constructed by the North Eastern and bear a great similarity to a 4-6-0 design, which is also new, for fast freight traffic. These engines use the same cylinder castings and the same boiler. The dimensions of the 0-8-0 type are given below:

Type	0-8-0
Gage	4 ft. 8½ in.
Service	Heavy freight
Fuel	Soft coal
Tractive effort	36,960 lb.
Weight in working order	160,380 lb.
Weight on drivers	160,380 lb.
Weight on engine and tender in working order	259,200 lb.
Wheel base, driving	18 ft. 6 in.
Wheel base, total	18 ft. 6 in.
CYLINDERS	
Kind	Simple
Number	3
Diameter and stroke	18½ in. x 26 in.
VALVES	
Kind	Piston
Number	3
Diameter	8¾ in.
WHEELS	
Diameter over tires	55¼ in.
BOILER	
Style	Straight
Working pressure	180 lb. per sq. in.
Outside diameter	66 in.
Firebox, length and width	9 ft. by 3 ft. 11 in.
Tubes, number and outside diameter	102—2 in.
Flues, number and diameter	24—5¼ in.
Stay tubes, number and diameter	7—2 in.
Tubes and flues, length	16 ft. 2⅝ in.
Heating surface, tubes	1,407 sq. ft.
Heating surface, firebox	166 sq. ft.
Heating surface, total	1,573 sq. ft.
Superheater surface	530 sq. ft.
Equivalent heating surface	2,368 sq. ft.
Grate area	27 sq. ft.
TENDER	
Tank	Six wheel
Weight	98,800 lb.
Water capacity	4,125 gallons
Coal capacity	5½ tons

ANTI-RUST COMPOUND

While statistics are not available, the total waste due to the rusting of machinery, tools, ordnance and metals amounts probably to millions of dollars annually. Various rust preventives invented and used from time to time have been more or less efficient in specialized fields. For example, paint is a most effective covering for products exposed to the weather. For bright polished steel surfaces, some form of heavy oil or grease is commonly used.

Experience with these compounds has developed the need for three inherent characteristics. First, they must form a protective covering and not melt easily. Under commercial conditions of storage and shipment, temperatures of 70 deg. F. to 100 deg. F., or higher, are common, and petroleum and other greases and compounds flow and drip off at these temperatures, exposing the bright surfaces to rust when the temperature has lowered and moisture collects on the metal. Second, they must be easily removed. Obviously a length gage, accurate to within .0001 in., cannot be covered with a compound that requires the application of emery cloth to remove it. The third requirement is ease of application.

A rust-preventing compound called Stazon, which is said to fulfill these three requirements, has been developed by the Conversion Products Corporation, New York. It is easily applied and removed by the simple act of wiping, and being an inert compound will not flow at high temperatures. To prove this fact a large number of trade-paper editors recently were invited to witness a demonstration. Four samples of anti-rust compounds, including Stazon, were placed on a metallic plate, the temperature of which was gradually raised by means of an electric resistance coil mounted on the back. The first compound started to melt at approximately 80 deg. F., and at 115 deg. F. three of the compounds had melted and completely run from the plate. Stazon remained and did not begin to soften until the temperature had reached over 200 deg. F., a temperature higher than would be found in any ordinary conditions of storage or shipment. It was stated that this compound when applied to metallic surfaces formed a coating impervious to moisture or atmospheric fumes.

RAILROAD AND INDUSTRIAL SHOP MANAGEMENT

A Frank Discussion of the Situation in Railroad Shops Compared with Industrial Conditions

BY C. C. EDMONDS

THE unsolved problems in the motive power and car departments of a railroad are numerous and knotty, but some of them are quite evident to the shop man or foreman who is in constant contact with the work. My own experience which has covered a number of years and a variety of railroad shops and roundhouses has brought me into contact with some of the simpler problems involved in these departments.

The railroad method of doing things had always seemed about right to me until chance dropped me into the manufacturing of high grade machinery and tools. Although not high in the official realm of the various manufacturers with whom I came in contact, I did have opportunity to see new methods and new systems, and was able to contrast them with what I had seen during my railroad days. Consequently, when I returned to railroad work this contrast was decidedly marked and, I must confess, not exceedingly favorable to the manner in which railroad shops are managed. Realizing as I do that the typical railroad shop is not of the production or repetition type of industry and that the work cannot be centralized as in industrial practice, it still seems to me that on many points the railroads are decidedly weak.

Handicapped by Lack of Equipment and Materials

An illustration of how production is held up on many railroads is furnished by the present conditions in a 23-stall roundhouse in the Middle West. The machinists are all well equipped with hammers and chisels, but other than that their equipment is negative. There were only three pipe wrenches in the entire place, and it was a case of waiting until the other fellow was through with them. The back up belt on the one and only lathe has been off six weeks waiting for the stores department to issue a new one, but so far the prospects are that it will be several more weeks before the belt is forthcoming. An order for an emery wheel brings results within two months, if sufficient pressure is brought to bear. A much delayed order for sheet rubber for gaskets necessitated the use of canvas and varnish to make a gasket for an air compressor.

The idea of withholding supplies from the mechanical department in order to prevent wastage results in enough time being used in making parts to pay for them many times over. Personally, I have often had to make parts of such common accessories as gage cocks and boiler checks, not to mention robbing other engines of such parts as had not previously been appropriated.

The lack of shop equipment is particularly noticeable after one has been fortunate enough to work for a progressive industrial concern. Electric lights are a rare novelty in a majority of the round houses in the United States, and a new installation warrants a full page or two in the company magazine. It was once my ill-luck to desire electric lights for a shop of which I was night foreman. Consequently, I found a junk dealer who was willing to give me a generator, wire, etc., for a corresponding amount of old iron. By dint of much hard labor and "raids" on various other departments, the system was finally installed and extended so that it included the office, storehouse, engine despatcher's house and the machine shop. We were most jubilant about our improvement, and everything went serenely until the superintendent of motive power made a little inspection trip and, noticing our system, inquired as to our authority for the same. As we had none, his highness ordered the removal of our pet, so that the place has since been and is still illumined by lanterns and oil lights.

Previous to this occurrence we had been fortunate enough to make a trade with our junk man friend for an old air compressor, so that when it had been rebuilt we were well fixed for air pressure. This unauthorized move likewise caused considerable correspondence and orders concerning further procedure, but as the old air pump had been dismantled and sent to the shops there was no option about keeping the new addition, which is still running satisfactorily. However, if ever again I feel in the mood for making improvements in shop equipment they will first be sanctioned by higher authority and the material will be furnished on order. Initiative may be a virtue, but it is apt to get one into trouble in a railroad shop.

No Encouragement for the Foreman

Some time ago in the *Railway Mechanical Engineer* the life of a roundhouse foreman was aptly described by the author who said that if one wanted to find the foreman he needed merely to look around and if there was an engine with a dome cap off then undoubtedly the foreman's legs might be seen waving in the air therefrom. If the foreman could devote his entire time to the condition of his power this description would not be so absurd, but when we find the same man the next minute sweating over an elaborate report we can better appreciate his predicament.

Besides the task of planning shop work for the men, the foreman is inspector, disciplinarian, shop despatcher, turntable expert, call boy, employment manager, machinist, bookkeeper and office manager. The majority of foremen until recently have been absolutely overloaded with clerical details which are foreign to their training or inclination. In theory the roundhouse clerk was hired to keep the time books and attend to reports, but in practice the foreman usually had to recheck the entire outfit. A reduction of the variety of the foreman's duties would be a much needed step toward improvement. No foreman in a progressive industrial plant is harassed with so confusing a variety of responsibilities. He has the time and is generally permitted to plan his work deliberately, with the result that far more is in reality accomplished.

Many large industrial plants find that foremen's meetings held occasionally are of great value, and while the element of distance might interfere it would seem that quarterly meetings would be a big help to the foreman in giving him opportunity to acquire new ideas and to learn of new methods. The foreman could well be supplied with the current number of a good trade journal applicable to his particular work, so that he can keep ahead of the times.

In order to secure better and increased production, loyalty to the road must be secured. This can be gained only where both parties to the contract are fair and square. Men working in a shop, however large or small, notice the attitude of the management toward the foremen, and if it is a fair one the men respond favorably. Otherwise they figure, "Well, the company doesn't seem to care about its executives, and so why should I strive for promotion?" Wherever one goes and talks to railroad men he either discovers that "This company is all right and will take care of me," or "This company is n. g. and isn't interested in me." In the first instance he

will find that the men are loyal and will do the right thing by the company, while in the second case he will observe that it is a case of getting by as easily as possible and an "I-should-worry" attitude toward their work.

Push vs. Pull

Promotion on merit is greatly inducive to loyalty. If a man can be assured that he will be either promoted on his merits or fail if he does not qualify, he will work to the best of his ability. Otherwise, the better men will leave for other work because of lack of opportunities in railroading. I have had the privilege of talking to at least a dozen of the bigger railroad mechanical men throughout this country, and in every case when asked, "Would you want to go into it again?" they have said, "No, it's too hard a game and absolutely thankless." Such an attitude by the "big" men does not speak well for the attitude one must of necessity find in the ranks. For this reason railroading today cannot be said to be a very attractive profession or job for a well-trained young man as compared with opportunities in the industrial field.

Besides securing the right attitude of the men toward better production by securing more loyalty through right treatment of executives and fair promotion, much could be gained by the elimination of the present practice of "meeting the dividend period." In the case of most roads a big reduction in the number of mechanical employees is usually made about two months before the end of the fiscal year so that the net income can be boosted a bit thereby. In more than one roundhouse I have seen an entire emergency crew of machinists and boilermakers, plus a goodly quota of master mechanics and roundhouse foremen, trying to give the regular force a lift over a hard cold spell. Invariably one can find on inquiring of the foreman that engines were slipped by during the summer simply because of the approaching dividend period.

A Business Organization Needed

The presence of a good, well-balanced organization means that friction between departments and men is reduced to a minimum, while a loose organization means every department or man for itself or himself. An instance with which I am familiar will illustrate the average type of organization which one finds in the railroads today. At a division point into which three divisions ran from various directions (the division offices being at the other end of the line), the roundhouse foreman received a wire ordering him to get a certain extra engine there ready to go out light over division No. 1. Shortly afterward division superintendent No. 3 was wiring for the engine, and then the home division, or No. 2, also claimed the engine. (It was just out of the shop.) No one seemed to know whose engine it was, so the roundhouse foreman put it switching and sent the telegrams to the superintendent motive power for him to straighten out the mess. Instances like the above are happening every day on the various railroads, and the result is no one knows who actually is boss.

It would seem that as other large companies, especially manufacturers, have proved that organization does pay, the railroads could well afford to get a definite understanding of the problem and then put the solution down in the form of an organization chart so that every man could have some idea of what his authority covered and to whom he was responsible. The constant "passing the buck" from one department to another could be stopped by higher officials requiring that their men assume responsibility and take the burdens together with the benefits. At present too many executives are simply a screen through which complaints, etc., are sifted until the little fellow (the fine mesh screen) has to catch it all and take his officers' burden. A demand that officers assume their own liability and no other should be strongly enforced, and the presence of an organization chart, together with some few standard written instructions as to general practice, should be of benefit. The present financial situation of the railroads is such as to make unlikely any betterment in tools and equipment, but nevertheless a goodly saving could be accomplished if the organization tangles could be straightened out and permanently recorded. The main expense involved would be the use of good, ordinary common sense and an efficiency expert would not be necessary, as the railroad men have plenty of brains and ability if only they could be given a chance to use them.

NEW PIECE WORK SYSTEM IN GERMAN SHOPS

A new system of piece work, which is of the nature of profit sharing, has been introduced in the government's railway repair shops at Golm-Mark and has led to increased production. A commission composed of a works manager, a delegate of the workers and a railway official calculates the number of hours necessary for the performance of a certain piece of work, on the basis of actual experience and average production. By a special scheme the saving in cost resulting from the difference between the actual number of hours worked and the calculated number is shared between workers and employers. Each individual worker is paid according to output and capacity on a scale arranged between the management and the workers. The resulting average of hours and wage rates is that for which payment is agreed upon in the repair contract. If, for instance, the agreed average price per hour is 2.30 marks plus 180 per cent for general expenses (some such percentage is usually allowed to every firm of contractors as compensation for expenses) the following result will obtain.

A railway freight car, according to the standard calculated, requires 500 hours for repair. The work is actually performed in 408 hours, so that a saving of 92 hours is effected. Ninety-two, the number of hours saved, multiplied by 2.30 marks gives 211.60 marks. The 180 per cent for expenses amounts to 380.88 marks; the sum of the two is 592.48 marks. Half of this sum, or 296.24 marks, goes to the gang of 10 workers employed on the job. The combined wages of these 10 workers for the job in question were 947.90 marks. The extra compensation of 296.24 marks paid to them for the saving in time amounts, therefore, to somewhat over 31 per cent.

Newly employed workers are paid a share of the profits after 12 days' work with their gang. The standard number of hours fixed by the commission is not reduced when the worker receives higher wages.

According to Vorwaerts (Berlin) this system has already been in use in the workshops for four months. As a result production has increased 100 per cent. Another advantage is that the employment of supervisors has become unnecessary. Further, if any member of a gang shows a lazy disposition the other members refuse to incur the loss of profit involved and demand his dismissal.

Hardening Gages with Minimum Distortion.—One of the laws governing the hardening of steel which has recently been discovered is that quenching while crossing an arresting or recalescence point produces the least amount of distortion. This is borne out by experiments conducted at Goldsmith's College, London, described in a paper before the Institution of Mechanical Engineers. In endeavoring to produce screw gages of extreme accuracy the effect of variations in the quenching temperature on a large number of gages was checked. While no temperature was found at which the steel was not distorted, the experiments showed that parts quenched at 700 deg. C. (1,292 deg. F.) increased in length by .0002 in. in .7 in. of length, which is within a pitch tolerance of .0003 in. per in. of length. Such slight errors are not serious as they can be removed by a grinding or lapping, which is usually necessary to give the required finish.

How Front End Air Leaks Can Be Prevented

Some of the Bad Effects of Front End Air Leaks and Means for Their Correction

IT IS questionable if the serious effects of front end air leaks are fully appreciated and whether adequate measures are being taken to prevent their bad effects. The direct result of air openings in the front end is to reduce the vacuum in the smokebox and lessen the draft on the fire. This in turn necessitates the use of a smaller nozzle area to produce the desired draft. A reduced nozzle increases the back pressure in the cylinders, from which it is apparent that the efficiency of the locomotive is directly affected by air leaks in the smokebox.

It has been pointed out that these air leaks do not usually develop suddenly and that their effect on the draft is gradual. Consequently as the steaming qualities of the locomotive are gradually impaired the nozzle is invariably bushed down or a bridge is required. If these front end air leaks occurred suddenly their effect would be so noticeable that they would unquestionably be investigated and corrected.

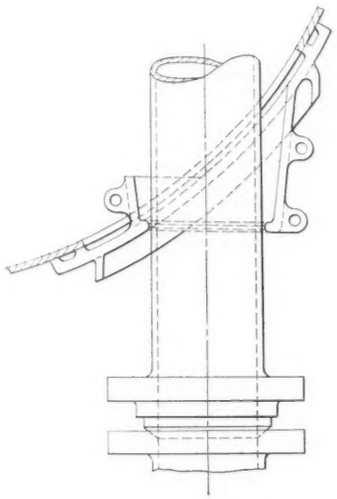


Fig. 1—Usual Type of Joint Between Smokebox and Outside Steam Pipe

The harmful effect of a front end air leak often remains after the leak itself has been stopped up, for after a nozzle has been bushed down or bridged to counteract the effect of an air leak in the front end, it is not always enlarged to its former dimensions as soon as the air leak has been closed. In fact, it is quite common for locomotives that have required a reduction in nozzle size for some cause or other, to keep on running with the reduced nozzle long after the immediate cause has been removed. Only the strictest supervision over this matter will result in the elimination of needlessly restricted nozzles.

Principal Cause of Front End Air Leaks

Outside steam pipes are not the only cause for front end air leaks but they can doubtless be regarded as the principal cause. The most troublesome point in connection with this construction has been to close the aperture in the smokebox shell through which the steam pipes pass to the cylinders. Obviously these pipes cannot be rigidly connected to the boiler shell at this point and must be allowed freedom of movement to allow for contraction and expansion. Outside steam pipes possessed so many advantages and adapted themselves so readily to superheater installations that the difficulty of maintaining a tight joint between the smokebox and the steam pipes was somewhat overlooked and the earliest joints intended to prevent air leaks have proved more or less inadequate from this standpoint.

Fig. 1 shows an arrangement that has been applied to a large number of locomotives. The gland is packed, preferably with asbestos rope, and if this packing is carefully maintained the joint will remain tight. However, it must be observed that the pressure on this packing, resulting from a vacuum in the front end, tends to loosen rather than compress the packing, and it will usually work loose so as to admit air, unless frequently attended to between shoppings. The use of any cement in this gland as a substitute or makeshift to reduce the time and expense of frequent repacking is not a desirable expedient. The cement soon develops cracks through which air is admitted to the smokebox, and often crumbles and drops out of the gland altogether. This is due to the fact that the cement contains moisture at the time the joint is packed which invariably dries out causing the packing to shrink around the steam pipes. The use of cement for this purpose cannot be too strongly condemned.

What Tests Developed

A simple torch test is all that is required to determine the presence of air leaks and it is earnestly recommended that this test be made *periodically* on *all* engines. At a single engine terminal recently where this test was applied at random to 29 engines, all but one were found to have air leaks around the steam pipe. On this railroad cement had replaced the asbestos packing and it was not the practice to test for air leaks unless the locomotive was reported for failure to steam. Similar tests conducted at terminals where the use of cement had not been resorted to developed a better state of affairs, but irrespective of the method of packing and even the type of construction, the entire elimination of front end air leaks can only be secured through the most vigilant inspection.

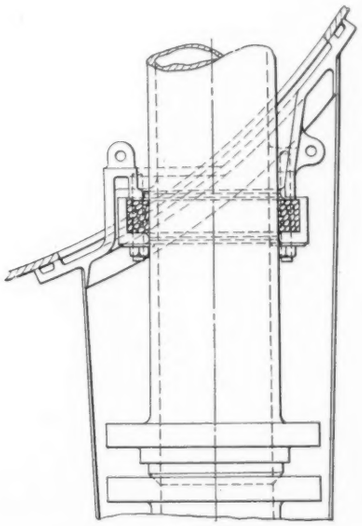


Fig. 2—Improved Type of Joint for Outside Steam Pipe

A test was conducted by the Fuel Conservation Section of the Railroad Administration for the purpose of determining the exact effect of reducing nozzles and disarranging

front end apparatus to overcome the effects of front end air leaks. In this test no particular locomotive was selected, the locomotive tested being one in regular chain gang freight service and assumed by all concerned to be in good condition. The first trip was made with the locomotive as found. On completion of the trip the openings around the steam pipes were packed with rope asbestos and it was found that this resulted in raising the average draft sufficiently to warrant an increase in the size of the nozzle. On the succeeding trip the openings around the steam pipes were again packed with asbestos and cement as a greater part of the packing had pulled out on the previous trip and a further enlargement of the nozzle was made. The results of successive test trips showed that with proper redrafting of the locomotive and stoppage of all air leaks, an increase of 9.3 per cent in the area of the exhaust nozzle was possible.

Improved Construction to Prevent Leaks

The use of a packing gland with means for maintaining the packing in place as shown in Fig. 2 is one of the most practical and certainly the most substantial means for obtaining a joint which, if properly packed, will remain tight from shopping to shopping. This form of construction was applied to quite a large number of locomotives, including

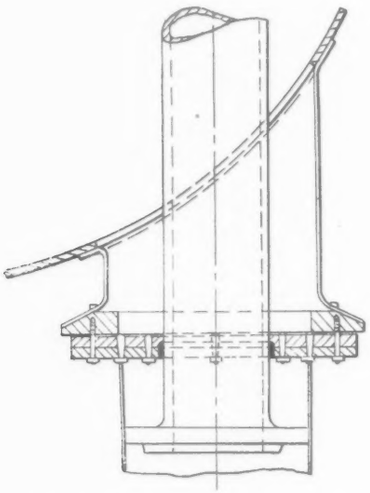


Fig. 3—Air Tight Joint Developed on Southern Pacific Lines

all of the locomotives built for the Railroad Administration. The application of this or an equivalent device to existing locomotives, as well as to all new power cannot be too strongly urged. The use of cement, as has been pointed out, is altogether unsatisfactory and the application of other material without means for holding it in place will necessitate frequent inspection and repacking.

Another form of construction designed to make the joint around the steam pipe air-tight which was first developed on the El Paso division of the Southern Pacific lines is shown in Fig. 3. The casing applied to the outside steam pipes is made of ¼-in. steel plate with a welded seam. This casing is riveted permanently to the smokebox and then caulked or welded around the edge to make it air-tight. It is large enough in diameter to permit the removal of the steam pipes and a wrought iron ring is attached to the lower end as shown. A cast iron flange made in halves is fitted together and bolted snugly around the steam pipe, which is machined true at this point. The cast iron flange is secured to the wrought iron ring by means of studs and a copper wire gasket inserted to obtain an air-tight joint. A copper gasket is then caulked into a dovetailed groove in the cast iron flange surrounding the steam pipe.

Other Means for Correcting Leaks

Front end air leaks around the steam pipes may be corrected on a large number of locomotives on which this has been a source of trouble, by redesigning or inserting an effective packing gland to protect this joint. Fig. 4 illustrates a device that was designed to prevent air leaks around the outside steam pipes, but has never proved very satisfactory from this standpoint. On locomotives so equipped it would be better to discard all of this casing, except the flanged piece attached to the smokebox, and substitute a

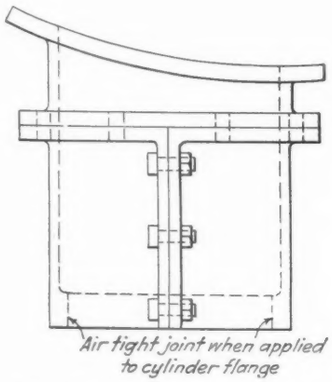


Fig. 4—Early Design to Prevent Air Leaks

stuffing box and packing gland as shown in Fig. 5, which, can be easily accomplished with the addition of two castings.

The problem of avoiding leaks at outside steam pipes is one that requires not only persistent attention in the engine terminal and shop, but should be carefully considered by mechanical engineers in designing new locomotives and improving old locomotives as they go through the shops. It is safe to say that wherever outside steam pipes are in use, a large percentage of locomotives will be found to have air

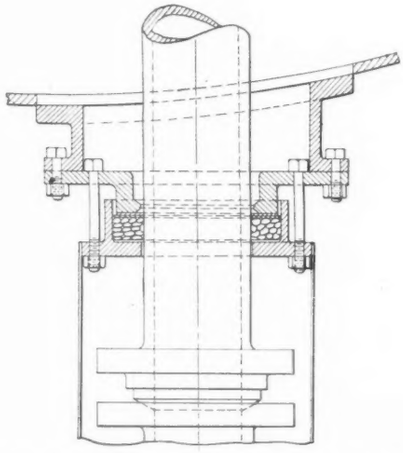


Fig. 5—Application of Stuffing Box and Gland to Design Shown in Fig. 4

leaks around the steam pipes, unless special precautions are taken in design as described in the foregoing, or unusual care is exercised with respect to this detail of locomotive maintenance. It is entirely possible that the design of an air-tight joint can be further improved, but it is of greater importance that the application of some of the improved designs already available be made more universal.

Individually, the front end air leak is never too small a matter to be overlooked and in the aggregate the loss in locomotive efficiency and capacity occasioned by front end air leaks will approach a surprising total on almost any railroad.

RAILROAD LABOR BOARD DECISION ANNOUNCED

Total Award $600,000,000; Flat Increase of Thirteen Cents an Hour for Foremen, Mechanics and Helpers

THE United States Railroad Labor Board on July 20 announced its decision in the demands of the labor organizations for increased wages and changes in working conditions. The board reserved decision on the questions regarding working conditions and awarded flat hourly increases over the rates established by the Railroad Administration. The average increase is approximately 21 per cent of the present rates of pay and will add about $600,000,000 to the annual pay roll.

In separating the question of wages from related subjects such as the continuation or elimination of the National Shop Agreement and the application of the award to the various outlaw organizations, the board stated that adequate investigation and consideration of these questions would demand much time and because of the existing tense labor situation it was desirable to make as early a decision of the wage question as practicable.

The actual additions to the total payroll of the larger classes of employees (allowing nothing for overtime) are estimated as follows:

		Approximate percentage increase
Yardmasters and train despatchers	$4,767,357	
Clerks	103,920,176	25
Maintenance of way employees	160,297,568	25
Mechanics and shop laborers	139,237,215	19⅝
Agents and telegraphers	21,281,669	23
Enginemen	65,025,012	23
Trainmen	91,561,335	
Marine employees	250,000	
Total	$586,340,336	

The introduction to the board's decision reads in part as follows:

In arriving at its decision, the Board has taken into consideration, as the Transportation Act prescribes:

"(1) The scale of wages paid for similar kinds of work in other industries;

"(2) The relation between wages and the cost of living;

"(3) The hazards of the employment;

"(4) The training and skill required;

"(5) The degree of responsibility;

"(6) The character and regularity of the employment, and

"(7) Inequalities of increase in wages or of treatment, the result of previous wage orders or adjustments."

The Board has been unable to find any formula which applied to the facts would work out a just and reasonable wage for the many thousands of positions involved in this dispute. The determination of such wages is necessarily a matter of estimate and judgment in view of all the conditions; a matter on which individuals will differ widely as their information or lack of it, their interest, situation and bias may influence them.

With reference to "the character and regularity of the employment," the Board finds that with few exceptions railroad employment is more regular, and the character of the work is more desirable than like occupations outside. As a rule railroad employees are such for life and usually remain for years with the same company. This permanence of employment has certain advantages which have been considered by the Board. With regard to "the scale of wages paid for similar kinds of work in other industries," and "the relation between wages and the cost of living," the Board has been under some difficulty. It is clear that the cost of living in the United States has increased approximately one hundred per cent since 1914. In many instances the increase to employees herein fixed, together with prior increases granted since 1914, exceed this figure. The cost of living and wages paid for similar kinds of work in other industries, however, differ as between different parts of the country. Yet standardization of pay for railroad employees has proceeded so far and possesses such advantages that it was deemed inexpedient and impracticable to establish new variations based on these already variable conditions.

It has been found by this Board generally that the scale of wages paid railroad employees is substantially below that paid for similar work in outside industry, that the increase in living cost since the effective date of General Order 27 and its supplements has thrown wages below the pre-war standard of living of these employees and that justice as well as the maintenance of an essential industry in an efficient condition require a substantial increase to practically all classes.

During the hearings, the "International Association of Railroad Supervisors of Mechanics," and "The American Train Dispatchers' Association" have been made parties to this dispute. In granting hearings to them, this Board has not assumed or decided any question of jurisdiction between the several organizations or associations either parties to or outside of this dispute.

The Board assumes as the basis of this decision the continuance in full force and effect of the rules, working conditions and agreements in force under the authority of the United States Railroad Administration. Pending the presentation, consideration and determination of the questions pertaining to the continuation or modification of such rules, condition and agreements no changes therein shall be made except by agreement between the carrier and employees concerned. As to all the questions with reference to the continuation or modification of such rules, working conditions and agreements, further hearings will be had at the earliest practicable date and decision thereon will be rendered as soon as adequate consideration can be given.

After giving the names of the various railroads affected, the decision outlines in detail the increases in wages, which are as follows:

ARTICLE II.—CLERICAL AND STATION FORCES.

Add to the rates established by or under the authority of the United States Railroad Administration for each of the hereinafter named classes, the following amounts per hour:

Sec. 1. Storekeepers, assistant storekeepers, chief clerks, foremen, subforemen and other clerical supervisory forces.....13 cents.

Sec. 2. Clerks with an experience of one (1) or more years in railroad clerical work, or clerical work of a similar nature in other industries, or where their cumulative experience in such clerical work is not less than one (1) year .....13 cents.

Sec. 3. Clerks whose experience as above defined is less than one (1) year, and until an experience of one (1) year in such work entitles them to the increase provided for in Section 2.....6½ cents.

Sec. 4. Train and engine crew callers, assistant station masters, train announcers, gatemen and baggage and parcel room employees (other than clerks) .....13 cents

Sec. 5. Janitors, elevator and telephone switchboard operators, office station and warehouse watchmen, and employees engaged in assorting way bills and tickets, operating appliances or machines for perforating, addressing envelopes, numbering claims and other papers, gathering and distributing mail, adjusting dictaphone cylinders and other similar work....10 cents.

Sec. 6. Office boys, messengers, chore boys and other employees under eighteen years of age, filling similar positions, and station attendants..5 cents.

Sec. 7. Station, platform, warehouse, transfer, dock, pier, store-room, stockroom and team-track freight handlers or truckers, and others similarly employed.....12 cents.

Sec. 8. The following differentials shall be created or maintained, as the case may be, between truckers and the classes named below:

(a) Sealers, scalers and fruit and perishable inspectors, one (1) cent per hour above truckers' rates as established under Section 7.

(b) Stowers or stevedores, callers or loaders, locators and coopers, two (2) cents per hour above truckers' rates as established under Section 7.

The above shall not operate to decrease any existing higher differentials.

Sec. 9. All common laborers in and around stations, storehouses and warehouses, not otherwise provided for.....8½ cents.

ARTICLE III.—MAINTENANCE OF WAY; UNSKILLED FORCES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per hour:

Sec. 8. Laborers employed in and around shops and roundhouses, such as engine watchmen and wipers, fire builders, ash-pit men, flue borers, coal passers (except those coming under the provisions of Article VIII, Section 3, this decision), coal chute men, etc.....10 cents.

ARTICLE IV.—SHOP EMPLOYEES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per hour:

Sec. 1. Supervisory forces .....13 cents.

Sec. 2. Machinists, boilermakers, blacksmiths, sheet metal workers, electrical workers, carmen, moulders, cupola tenders and coremakers, including those with less than four years' experience, all crafts.....13 cents

Sec. 3. Regular and helper apprentices and helpers, all classes..13 cents.

Sec. 4. Car cleaners .....5 cents.

ARTICLE V.—ESTABLISHES NEW RATES FOR TELEGRAPHERS, TELEPHONERS AND AGENTS.

ARTICLE VI.—ENGINE SERVICE EMPLOYEES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per mile, per hour, or per day, as the case may be, except in Section 4, as noted:

Sec. 1.—Passenger Service.

Class	Per mile, cents	Per day
Engineers and motormen	.8	$0.80
Firemen (coal or oil)	.8	.80
Helpers (electric)	.8	.80

Sec. 2.—Freight Service

Class	Per mile, cents	Per day
Engineers (steam, electric or other power)	1.04	$1.04
Firemen (coal and oil)	1.04	1.04
Helpers (electric)	1.04	1.04

Sec. 3.—Yard Service

Class	Per hour, cents
Engineers	18
Firemen (coal or oil)	18
Helpers (electric)	18

Sec. 4.—Hostler Service

Note.—Superseding rates established by or under the authority of the United States Railroad Administration, and in lieu thereof, for each of the hereinafter named classes, the following increased rates are established:

Class	Per day
Outside hostlers	$6.24
Inside hostlers	5.60
Helpers	5.04

ARTICLE VII.—TRAIN SERVICE EMPLOYEES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per mile, per day, or per month, as the case may be, except in Section 4, as noted:

Sec. 1.—Passenger Service

Class	Per mile, cents	Per day	Per Month
Conductors	.67	$1.00	$30.00
Assistant conductors or ticket collectors	.67	1.00	30.00
Baggage men handling both express and dynamo	.67	1.00	30.00
Baggagemen operating dynamo	.67	1.00	30.00
Baggagemen handling express	.67	1.00	30.00
Baggagemen	.67	1.00	30.00
Flagmen and brakemen	.67	1.00	30.00

Sec. 2.—Suburban Service (Exclusive)

Class	Per mile, cents	Per day	Per Month
Conductors	.67	$1.00	$30.00
Ticket collectors	.67	1.00	30.00
Guards performing duties of brakemen or flagmen	.67	1.00	30.00

Sec. 3.—Freight Service

Class	Per mile, Cents	Per day
Conductors (through)	1.04	$1.04
Flagmen and brakemen (through)	1.04	1.04
Conductors (local or way freight)	1.04	1.04
Flagmen and brakemen (local or way freight)	1.04	1.04

Sec. 4.—Yard Service

Note.—Superseding rates established by or under the authority of the United States Railroad Administration, and in lieu thereof, for each of the hereinafter named classes, the following increased rates are established:

Class	Per day
Foremen	$6.96
Helpers	6.48
Switchtenders	5.04

ARTICLE VIII.—STATIONARY ENGINE (STEAM) AND BOILER ROOM EMPLOYEES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per hour:

Sec. 1. Stationary engineers (steam).....13 cents.

Sec. 2. Stationary firemen and engine room oilers.....13 cents.

Sec. 3. Boiler room water tenders and coal passers.....10 cents.

ARTICLE IX.—REFERS TO SIGNAL DEPARTMENT EMPLOYEES

ARTICLE X.—ESTABLISHES NEW RATES FOR MASTERS, OFFICERS AND PILOTS OF RAILROAD FLOATING EQUIPMENT

ARTICLE XI.—OTHER SUPERVISORY FORCES

Add to the rates established by or under the authority of the United States Railroad Administration, for each of the hereinafter named classes, the following amounts per hour:

Sec. 1. Train despatchers .....13 cents.

Sec. 2. Yard masters and assistant yard masters.....15 cents.

ARTICLE XII.—MISCELLANEOUS EMPLOYEES

Add to the rates established by or under the authority of the United States Railroad Administration, for employees in the hereinbefore named departments who are properly before the Board and not otherwise provided for, an amount (as per Section 3, Article XIII) equal to that established for the respective classes to which the miscellaneous classes herein referred to are analogous. The intent of this article is to extend this decision to a miscellaneous class of supervisors and employees, practically impossible of specific classification, and at the same time to insure to them the same consideration and rate increase as provided for analogous service.

ARTICLE XIII.—GENERAL APPLICATION

Sec. 1. The increases in wages and the rates hereby established shall be effective as of May 1, 1920, and are to be paid according to the time served to all who were then in the carriers' service and remained therein, or who have since come into such service and remained therein.

Sec. 2. The provisions of this decision will not apply in cases where amounts less than thirty dollars ($30.00) per month are paid to individuals for special service which takes only a portion of their time from outside employment or business.

Sec. 3. Increases specified in this decision are to be added to the hourly rates as established by or under the authority of the United States Railroad Administration for employees now being paid by the hour. For employees paid by the day, add eight times the hourly increase specified to the daily rate. For employees paid by the month, add two hundred and four (204) times the hourly rate specified to the monthly rate.

Sec. 4. Each carrier will in payment to employees on and after August 1, 1920, include therein the increases in wages and the rates hereby established.

Sec. 5. The amounts due in back pay from May 1, 1920, to July 31, 1920, inclusive, in accordance with the provisions of this decision, will be computed and payment made to the employees separately from the regular monthly or semi-monthly payments, so that employees will know the exact amount of their back payments:

Recognizing the clerical work necessary to make these computations for back pay and the probable delay before the entire period can be covered, each month, beginning with May, 1920, shall be computed as soon as practicable, and as soon as completed, payment shall be made.

Sec. 6. The increases in wages and the rates hereby established shall be incorporated in and become a part of existing agreements or schedules.

Sec. 7. Except as specifically modified herein, the rules regulating payments of overtime or working conditions in all branches of service, and the established and accepted method of computing time and compensation thereunder, shall remain in effect until or unless changed in the manner provided by the Transportation Act, 1920.

Sec. 8. It is not intended in this decision to include or fix rates for any officials of the carriers affected except that class designated in the Transportation Act of 1920, as "Subordinate Officials," and who are included in the act as within the jurisdiction of this Board. The Act provides that the term "Subordinate Officials" includes officials of carriers of such class or rank, as the Interstate Commerce Commission shall designate by regulation duly formulated and issued. Hence, whenever in this decision words are used, such as "foremen," "supervisor," etc., which may apply to officials as are now or may hereafter be defined and classified by the Interstate Commerce Commission as such subordinate officials.

ARTICLE XIV.—INTERPRETATION OF THIS DECISION

Sec. 1. Should a dispute arise between the management and the employees of any of the carriers as to the meaning or intent of this decision, which cannot be decided in conference between the parties directly interested, such dispute shall be referred to the United States Railroad Labor Board in the manner provided by the Transportation Act, 1920.

Sec. 2. All such disputes shall be presented in a concrete joint signed statement setting forth: (1) the article of this decision involved. (2) the facts in the case. (3) the position of the employees, and (4) the position of the management thereon. Where supporting documentary evidence is used it shall be attached in the form of exhibits.

Sec. 3. Such presentations shall be transmitted to the Secretary of the United States Railroad Labor Board, who shall place same before the Board for final disposition.

By order of the Chairman.

The representatives of the labor organizations held sessions after the award was announced, but were unable to come to an agreement regarding the action to be taken. Five of the organizations accepted the award outright. Of the shop crafts unions the Railway Employees Department of the American Federation of Labor referred the award to the employees without recommendation. The Sheet Metal Workers' International Alliance, the Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, the Brotherhood of Railway Car Men of America, the International Brotherhood of Electrical Workers, the International Brotherhood of Boiler Makers, Iron Ship Builders and Helpers of America, and the International Brotherhood of Blacksmiths, Drop Forgers and Helpers referred it to the membership and recommended its acceptance.

CAR DEPARTMENT

CONSTRUCTION OF STEAM HOSE

Earlier Data Contradicted. Tests Show Duck with Braid Inferior to Duck Alone. Seamless Tube Best

AT the 1919 convention of the American Society for Testing Materials there was presented a paper on steam hose for car heating by H. J. Force.* This paper discussed tests of hose made from duck alone and from duck with one or more layers of braiding, and also compared the service of machine-made tubes with three-ply calendered tubing. As a result of these tests the author recommended that steam hose should be made of a composition of duck and braid and that the machine-made tubes should not be used, tubing of three-ply calender being applied in every case on hose which is to be subjected to any considerable degree of temperature.

At the convention of this association held in June, 1920, John M. Bierer, in a paper on the construction of steam hose, described three series of tests which also compared the effect of differences in the tube and fabric. The conclusions reached by the three investigators are opposed to those given in Mr. Force's paper. A summary of the paper by Mr. Bierer is given below.

Steam hose can be constructed with a seamless machine-made tube, or with a tube plied from calendered stock. Furthermore, the hose can have for its fabric element a duck of given weight and number of plies or a combination of plied duck and one or more plies of braid. To determine whether it is more satisfactory both to user and to manufacturer to make a seamless or a plied tube, and to make a simple multiple-ply duck construction or a combination duck and braid construction, three series of tests, carried out individually and independently by the B. F. Goodrich Co., the Goodyear Tire and Rubber Co., and the Boston Woven Hose and Rubber Co., have been made, the results of which are here shown.

The actual steam hose tested by the three investigators was obviously of different material, particularly as to compounds, so it is enlightening to survey the different series separately in order not to make the materials a factor in any comparison of constructions.

The tests by the B. F. Goodrich experimenters endeavored to compare both seamless with plied tubes and simple duck with duck-braid construction. All samples were 1⅝ in. in inside diameter, with tube ⅛ in. thick, cover 1-32 in. thick, duck 20 oz. per sq. yd., and braid 12 2-3 yarn. The hose was tested in a vertical position (so as not to have condensed steam present), under intermittent steam pressures, ten hours under pressure and two hours rest, until failure.

The results of the Goodrich tests are summarized in Table I. Each result represents an average of five individual samples of each construction.

Sample *B* was of distinctly lighter weight than *A* or *C*, so it is not surprising that failure occurred earlier than the A and *C* samples, which were comparable to each other. *C* and *D* were different only in the construction of tube, so that the longer service of *C* was undoubtedly due to the absence of seams, joints, or plied surfaces, which tend to open up. Similiarly, *A* and *C* were different in fabric construction, with the same tube, so that the better endurance of *C* can safely be laid to the superiority of the simple plied duck to the braid and duck construction.

It takes little studying of these experiments to notice two facts already known to many familiar with steam hose. The steam hose with seamless tube lasted about half again as long as that with a plied tube; and likewise the hose with simple duck of sufficient plies lasted about half again as long as the hose with a combination of duck and braid.

Summarizing the experiments of the Goodyear Tire and Rubber Co., there appears a series of similar results. Table II represents an average of five individual samples of each construction. Comparison is offered in this series also of seamless and plied tubes, of duck and duck-braid constructions, and of expansion and contraction measurements as well. Like the Goodrich tests, the hose was tested ten hours

TABLE I.—RESULTS OBTAINED IN TESTS BY B. F. GOODRICH CO.

	Sample			
	A	B	C	D
Number of plies of duck	3	4	6	6
Number of plies of braid	2	0	0	0
Tube	Seamless	Seamless	Seamless	Plied
Endurance under 60-lb. pressure, hours	2,261	904	3,143	2,170

*See Railway Mechanical Engineer for September, 1919, page 527.

under 60 lb. steam pressure and two hours rest until failure.

Owing to details of manufacture, there is necessarily not found the same percentage ratios of endurance among the various constructions that were found in the Goodrich tests, but inspection of the results will reveal certain facts more important than this detail. The hose with the seamless tube *C* outlasted that with the plied tube *D* and the hose with the simple plied duck construction *C* outlasted that with a combination of duck and braid *E*. These results, though not so strikingly shown, are in accordance with those obtained in the Goodrich experiments. A further feature should be noted, that though the expansion in lateral dimensions and contraction in length are favorable to the duck-braid construction, the difference is so small between the two styles that any real and practical superiority for the braided hose would be negligible in practice.

The next experimental data to show divergence among the constructions are those obtained at the Boston Woven Hose and Rubber Co. laboratories. In order to determine the relative value of a hose with simple plied duck and hose with a combination of duck and braid, and to determine the relative value of seamless tubes and plied tubes, the following constructions were given prolonged tests. All

Table II.—Results of Experiments of Goodyear Tire and Rubber Co.

	Sample				
	A	B	C	D	E
Number of plies of duck	2	4	6	6	3
Number of plies of braid	2	0	0	0	2
Tube	Seamless	Seamless	Seamless	Plied	Seamless
Endurance under 60-lb. pressure, hours	1,506	1,198	1,624	1,493	1,612
Expansion of diameter in 1,000 hours, per cent	6.1	12.2	8.2	8.1	7.0
Contraction in length in 1,000 hours, per cent	1.6	3.2	3.7	3.6	1.8

hose was of 1-in. inside diameter ⅛-in. tubes, 0.050-in. covers and was tested in 3-ft. lengths. Two series of tests were carried out: the first at 60-lb. steam pressure intermittently 124 hours on and 44 hours rest, the second continuously at 180-lb. pressure, both until failure. Eight individual samples were tested in each series and the results summarized are an average of these:

For a given fabric construction, hose with seamless tubes *A* lasted about one-fifth again as long and *B* almost twice as long as those with plied tubes *C* and *D*. Furthermore, for the same style of tube, hose with simple plied duck *A* lasted half again as long, and *C* over twice as long as those with duck and braid construction *B* and *D*.

In these tests, owing to particularly careful workmanship on the samples, failure was not due primarily to separation of the seam or joint on the inner surface of the tube. But in the ordinary process of manufacture, without such undue care and special attention, the plied tube is always a danger, and this splitting and opening up of the tube is practically

Table III.—Results Obtained by the Boston Woven Hose and Rubber Co.

	Sample			
	A	B	C	D
Number of plies of duck	6	3	6	3
Number of plies of braid	0	2	0	2
Tube	Seamless	Seamless	Plied	Plied
Endurance under 60-lb. intermittent pressure, hours	2,607	1,770	2,143	950
Endurance under 180-lb. constant pressure, hours	67	26	62	17

a fatal objection to the success of any hose by this method. This series is a clear case of superiority of seamless tubes over plied tubes, and of simple plied duck over a combination duck and braid construction.

Conclusions

Three different experimental laboratories, working individually and independently, found consistent results in an effort to determine the relative values of seamless and plied tubes, and of simple duck and duck supplemented by braiding. From the data gathered, there are two conclusions concerning these relative values which are obvious and irrefutable:

1. Steam hose made with seamless tubes (in practice by the tube-machine method) is superior in endurance under steam pressure to hose with tubes made up of successive plies of a sheeted stock, sometimes known as a calendered tube. The hose with plied tubes was found to fail by the splitting and separation of the seam necessarily formed at the surface of the tube in its construction.

2. Steam hose with its fabric constructed of successive plies of frictioned duck is superior in endurance to, and the practical equal in expansion and contraction of, hose made of a fewer number of plies of duck supplemented by plies of braiding.

The inevitable conclusion must be that it is most advantageous to the user and to the manufacturer alike to construct steam hose with a seamless tube and for its fabric element sufficient number of plies of duck only.

CHANGES IN THE RULES OF INTERCHANGE

The following modifications in the Rules of Interchange have been approved by the Executive Committee of the American Railroad Association and issued as Circular S III—163.

Effective March 1, 1920, all modifications of these rules having special application only to railroads under U. S. Federal control are cancelled, being superseded by the General Rules.

Rule 3.—The effective date of Section (d) of this rule has been extended to October 1, 1922, and the rule modified to read as follows:

Cars built prior to October 1, 1915, will not be accepted in interchange after October 1, 1922, unless equipped with A. R. A. Standard axles.

The effective date of Section (i) of Rule No. 3 has been extended until October 1, 1922, and the rule modified to read as follows:

After October 1, 1922, no cars with trucks of less than 60,000 lb. capacity will be accepted in interchange unless equipped with wooden or metal draft arms extending beyond body bolster, metal draft arms integral with body bolster, metal draft arms extending to body bolster and securely riveted to same, or transom draft gear.

Effective August 1, 1920, Rule 93 is modified to read as follows:

Separate bills shall be rendered for cars destroyed.

Separate bills shall be rendered for the periodical repacking of journal boxes.

All charges for repairs made to cars on account of owner's defects, defect cards and rebuttal authorities shall be consolidated against any one company into one bill; however, separate bill shall be rendered for the period subsequent to February 29, 1920.

Separate statements to be made.

1. For owner's defects for each calendar month.
2. For all charges based on defect card, including rebuttal charges.

Note.—Totals only of these statements to be shown on the recapitulation.

The title and address of the officer to whom correspondence should be forwarded relative to exceptions to charges should appear on the bill.

This circular should be considered as a supplement to the Rules of Interchange, and necessary instructions issued to all concerned. These modifications to the Rules of Interchange will be incorporated in the next supplement issued to these rules.

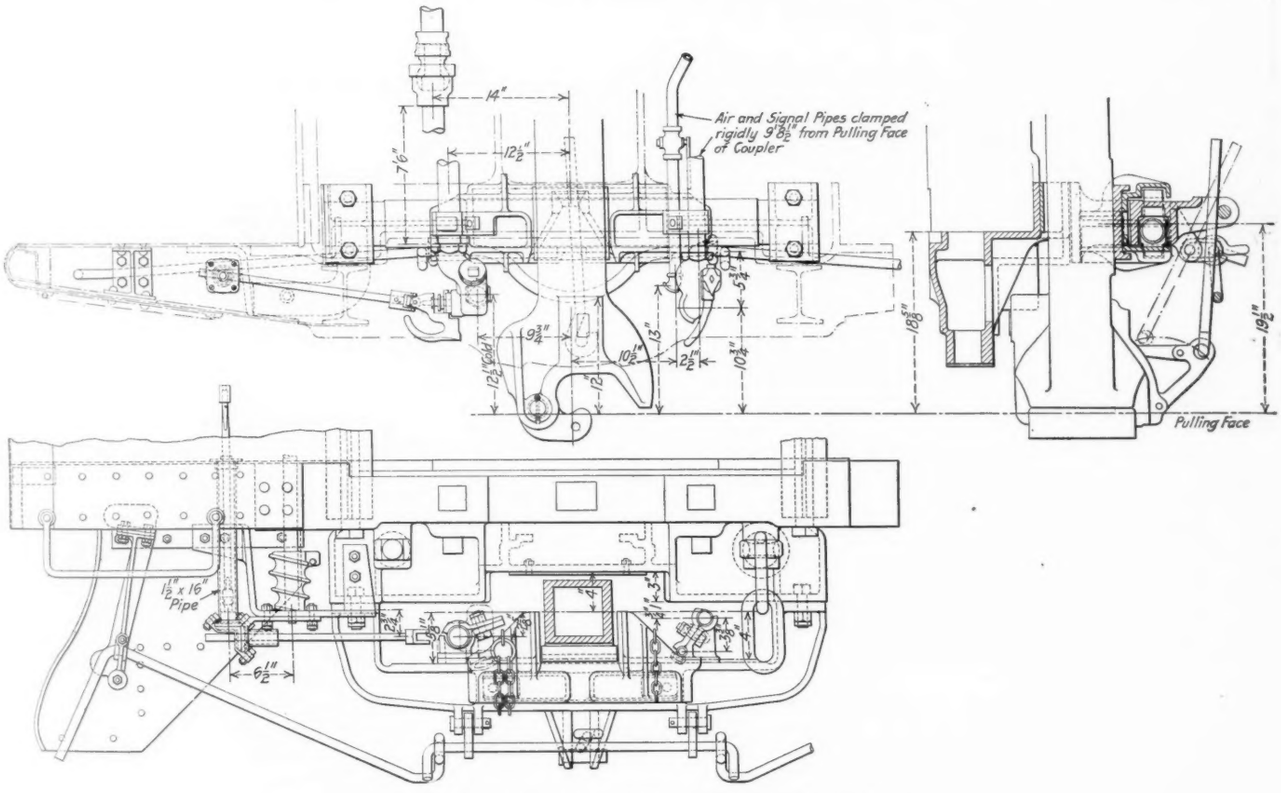
THE TYPE "D" COUPLER IN PASSENGER SERVICE

Difficulties Involved in Its Application; How the Problem Was Solved on New Pullman Cars

THE first application of the standard Type "D" coupler to passenger equipment has been made by the Pullman Company on the new sleeping cars which are now being built at a rate to approximate an output of about 600 cars a year. Adaptation of the Type "D" coupler to passenger cars, without alteration from its standard form as designed for freight service, involves considerable difficulty, its large overall dimensions causing it to interfere with the standard location of the train pipe connection. The trouble occurs on the knuckle or operating side of the coupler, which at its widest point extends about 7¾ in. from the center line of the stem.

The standard location of train pipe connections requires a distance of 20 in. between the center of the connection for the signal hose and that for the steam hose, with the steam hose connection 9½ in. from the center line of the car. With the steam-heat connection but 12 in. back of the inside face of the coupler knuckle, it will be seen that with the draft gear compressed there is very little clearance between the steam end valve and the side of the coupler when the coupler stem is on the center line of the car. This clearance is entirely inadequate to take care of the lateral swing of the coupler in curving. To increase the distance of the steam hose connection from the center line of the coupler would require a corresponding decrease in the distance from the center line of the coupler to the brake and signal hose connections, as the total distance between the two sets of connections is fixed and cannot be varied without requiring an entire readjustment of hose lengths. To move these connections over, however, in order to increase the clearance between the coupler and the steam end valve would tend to shorten the distance between the brake and signal hose connections and increase the distance between the steam hose connections on the adjoining ends of coupled cars. This condition, combined with certain conditions encountered in curving, would tend to cause the coupled steam hose to raise and separate the air hose couplings.

The solution finally arrived at by the Pullman Company and worked out for application on the sleeping cars now being built, is shown in the illustrations. Essentially this scheme involves the maintenance of a fixed relation between the center line of the coupler shank and the pipe connections, the latter being carried with the coupler in its lateral motion. This was accomplished by the design of a special coupler carrier casting with a long bearing face on which was placed a sliding saddle carrying the coupler and the ends of the train pipes. The bearing surface of the coupler carrier casting has a width of 4¾ in. and a total length of 38½. The coupler saddle casting is 29 in. long.



Application of the Type "D" Coupler to Pullman Cars

Between the top and bottom flanges of the I-section of the carrier casting the web member is omitted for a distance of 20 in. at the center to accommodate a centering spring and followers. With the spring and followers inserted, the saddle casting is placed over the carrier casting, pockets in the sides of the saddle being provided for the ends of the followers. The single coil spring is assembled with an initial load of 200 lb. and has a full load of about 600 lb. under the maximum travel of the saddle of 5½ in. either way from the center. The coupler stem has a clearance of ¾ in. on either

side from the vertical retaining faces of the saddle casting to take care of the angularity of the stem with relation to the saddle under maximum lateral movement.

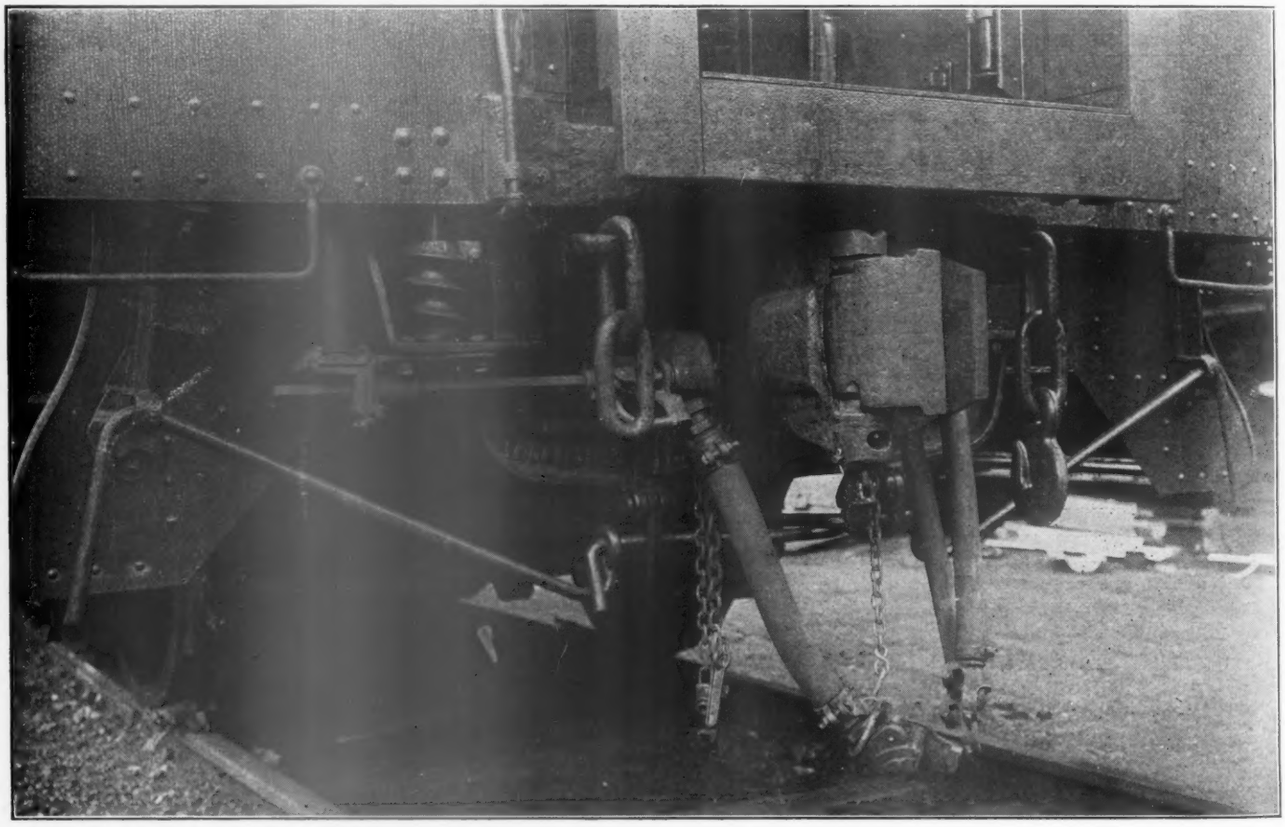
Both the carrier and saddle casting are relieved of lateral strains by the design of the platform and casting, which extends out at either side of the coupler shank to provide lateral stops. The coupler carrier is a steel casting while the saddle is of malleable iron with a movable shoe to take the wear of the coupler stem.

Brackets for support of the brake, signal and steam heat pipes are cast integral with the saddle casting. The brake and signal pipes are fastened with a single clamp which holds them rigidly in place. The steam pipe clamp is designed to close without tightly gripping the pipe, in order to provide for longitudinal expansion.

One of the problems which had to be solved in developing this arrangement was the provision of the necessary flexibility in the pipes to permit the required amount of lateral motion. The air pipes offered no particular difficulty, as it was found that by locating the first clamp a distance of 9 ft. 8½ in. from the end of the car sufficient flexibility was provided in the pipe itself to take up the lateral motion without undue stress. Inasmuch as there are two rigid clamps between the end of the car and the first pipe joint no trouble is anticipated in maintaining tight train lines.

It was found, however, that the 2-in. steam heat pipe was too large to take up the lateral motion without unduly stressing the joints and making it impossible to keep them tight. A Barco universal joint was therefore inserted in the pipe at a distance of about 7 ft. 6 in. back of the end valve. One of the interesting problems encountered in this connection was the difficulty of maintaining a tight joint between the end of the pipe and the bronze ball joint member. This was overcome by threading the end of the ball joint member on the outside and inserting it inside the steel pipe connection, the difference in expansion of the two metals thus tightening instead of loosening the joint.

Probably the most difficult problem encountered in working out the details of the flexible pipe arrangement was that of providing a satisfactory mechanism for operating from inside the vestibule the movable steam heat end valve. The device by which this is accomplished is simple, self-contained, and requires little special care in locating it on the car to insure freedom of operation. The motion of the vertical operating shaft is transmitted to the valve through bevel gears to a horizontal sliding shaft of square section. The cored hole through the hub of the lower gear is tapered from its smallest section in the middle toward each end, thus providing for considerable angular movement as well as the longitudinal movement of the horizontal shaft, to take care of the effect of expansion and contraction of the steam pipe, the lateral movement of the end and slight variations in the relationship of parts in assemblying.



End View of a Pullman Car With Type "D" Coupler Application

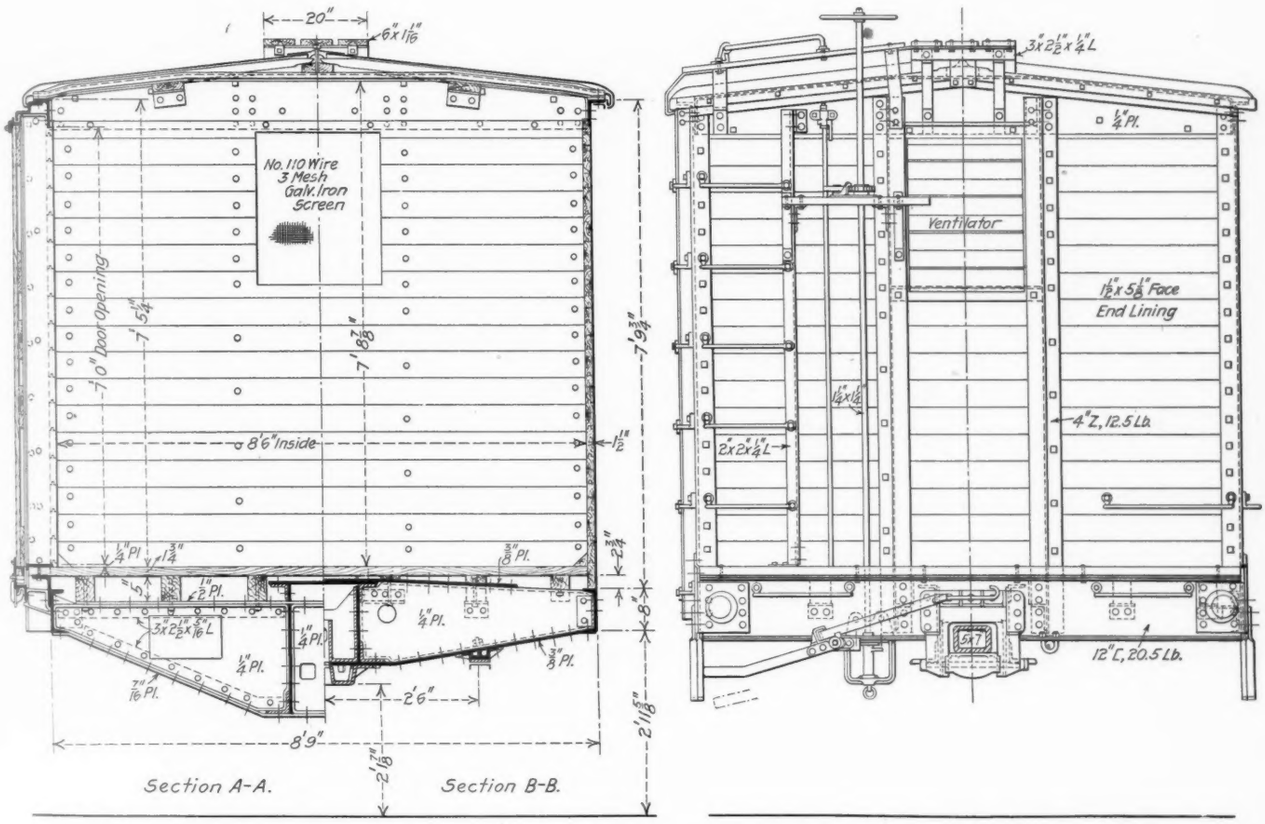
The lower end of the vertical shaft is also square in section and is tapered where it is inserted in the upper gear. To eliminate the necessity for precision in locating the gear casing with relation to the opening in the vestibule floor, this shaft is provided with a universal joint so that slight inaccuracies of alinement are taken care of without causing the parts to bind.

With the exception of the shafts, the parts of the device are all malleable castings and only such finish is provided for as is necessary to secure proper working alinement of the gears. The casing is made in three pieces, one of which is cast integral with the bracket by which the device is attached to the brake step. The gears are provided with finished hubs which have their bearings in reamed or drilled holes in the casing.

Box Cars for the Cuba Railroad

Forty Ton Capacity Single Sheathed Steel Frame Equipment of Exceptionally Strong Construction

CAR equipment for foreign railways is usually of interest by reason of the divergence from American standards of design. However, the Cuba Railroad has recently put into service some box cars which in strength and general design compare favorably with similar types in this country. These cars were designed and built by the American Car & Foundry Company. The first lot was recently completed and an additional order is now under construction. The cars are of the single sheathed type with steel underframes and steel superstructure. The nominal capacity is 36,400 kilos, or 80,247 lb., and the length over the end sills is 38 ft. 0 in. The light weight is approximately 40,000 lb. The car body is 36 ft. 6⅞ in. long inside, the inside height and width being 7 ft. 5¼ in., and 8 ft. 6 in., respectively.



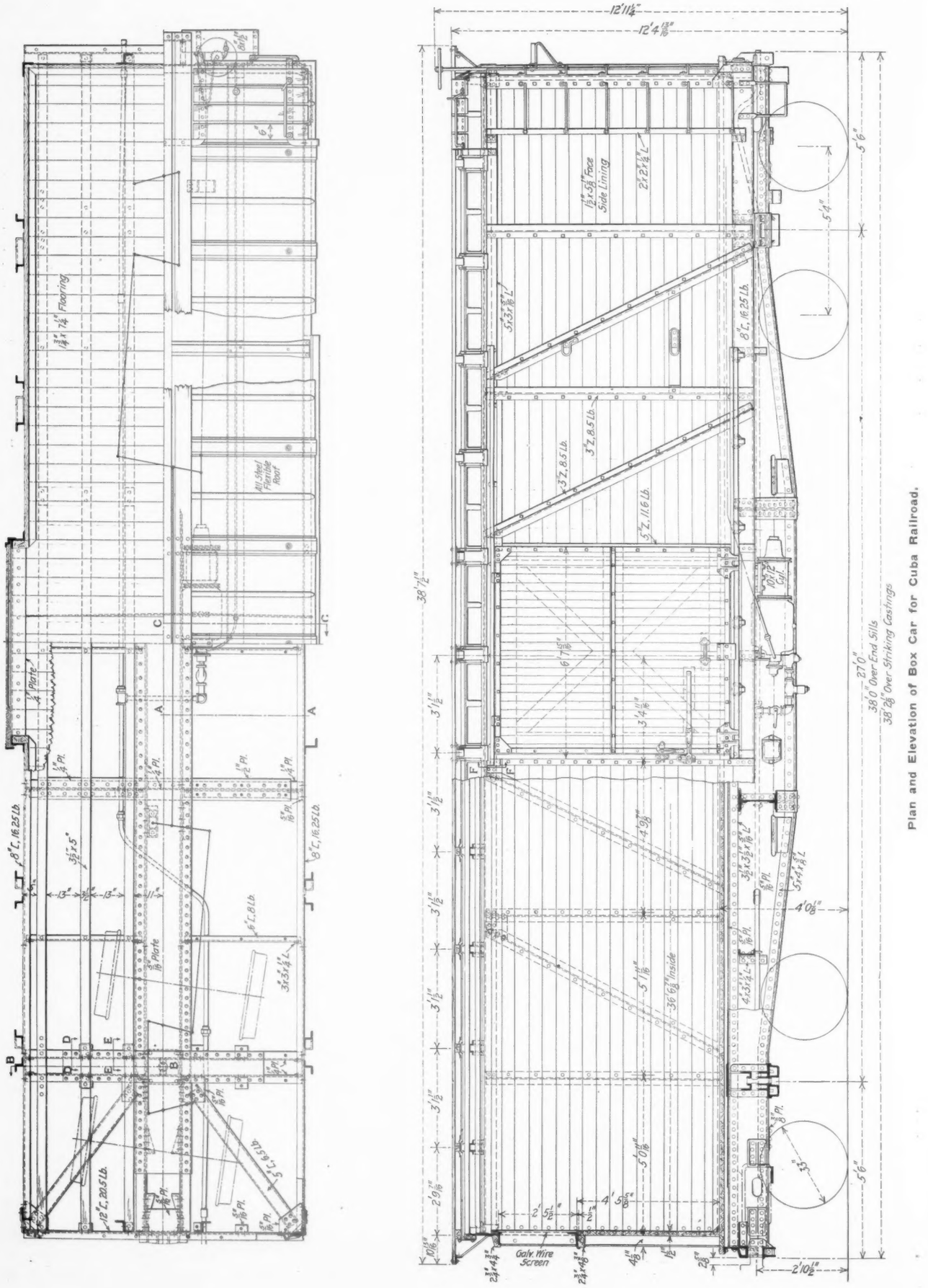
End Elevation and Sections of 40-Ton Box Car for Cuba Railroad.

Underframe

The underframe is built up of rolled shapes and plates, comparatively few pressed steel parts being used. The center sill is of the fishbelly type, consisting of two steel side numbers continuous between the end sills. They are made of 15/16-in. plates with top chords of 3½-in. by 3½-in. by 5/16-in. angles and bottom chords of 5-in. by 4-in. by ⅝-in. angles with the long flanges placed horizontally. The sills are 24¾ in. deep for a length of 10 ft. 4 in. at the center and taper to 15 in. deep just inside of the body bolsters. The web plates are reinforced vertically with 4-in. by 3-in. by ¼-in. angles. A steel top cover plate 5/16 in. thick and 21 in. wide is riveted over the greater portion of the center sill, extending to a point approximately over the center of the draft gear. The body bolsters consist of two ¼-in. pressed steel diaphragms with 3-in. flanges all around, spaced six inches apart. Each bolster is reinforced at the top by a 12-in. by ⅜-in. cover plate, extending a short distance beyond the side bearings, and at the bottom by a 13-in. by ⅜-in. plate, extending the full width of the car. The bolsters have cast steel center plates and center fillers and malleable iron side bearings. The top of the bolster slopes downward from the center sill and the top of the side sill is 1⅜-in. lower than the top of the center sill. The side sill is of 8-in. 16¼-lb. channel section and extends continuously from end sill to end sill.

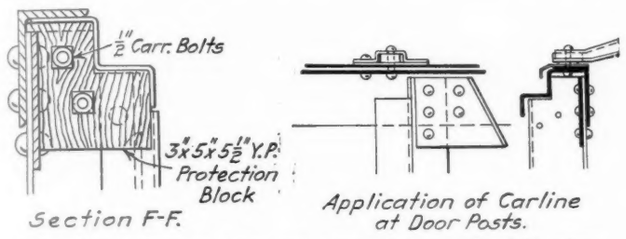
There are two crossbearers, spaced 9 ft. 3½ in. apart. Each consists of a ¼-in. pressed open hearth steel diaphragm, flanged three inches wide on all sides. A filler of similar construction is placed between the center sills. The crossbearer is reinforced at the top and bottom with a 3-in. by 2½-in. by 5/16-in. rolled steel angle. The top cover plate is 8 in. by ½ in. and extends through the center sill web plates. The bottom cover plate is 8 in. by 7/16 in. and extends continuously from side sill to side sill, passing under the center sill.

At the center of the car and midway between the body bolsters and crossbearers there are floor beams consisting of 6-in., 8-lb. channels, secured to the side and center sills by



Plan and Elevation of Box Car for Cuba Railroad.

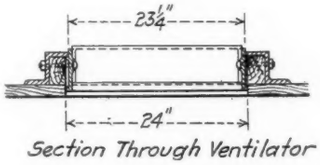
means of the vertical stiffening angles, and also by pressed angle connections, as shown in the sectional drawing. The end sills are 12-in., 20½-lb. channels and extend straight along the full section for the entire width of the car. A 5-in., 6½-lb. channel extends from the corner of the body bolster and center sill to the corner of the car, where it is attached to the side sill and end sill by means of flanged gusset plates. The draft gear is of the Cardwell friction type with Sharon couplers operated by the American Car & Foundry Company's direct-connected top operating uncoupling device.



Side Plate Section at Floor and Arrangement of Roof Members

Superstructure

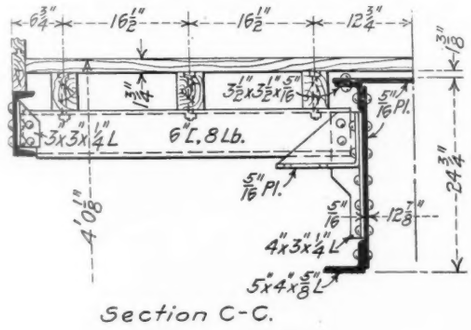
Both the vertical and horizontal intermediate members of the side truss are 3-in., 8½-lb. Z-bars, securely riveted to the side sill and to the side plate, which is a 5-in. by 3-in. by 5/16-in. angle with the short flange extending outward.



Section of End at Ventilator

The door posts are 5-in., 11.6-lb. Z-bars. A pressed steel section attached to the flange of the side plate serves as reinforcement over the door opening and also as weather protection for the door. The side sill is reinforced under the door opening by a 5¾-in. by 3¾-in. by 5/16-in. bent angle.

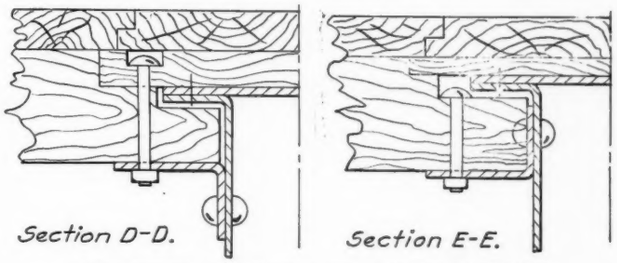
The corner posts are 5-in. by 4-in. by ⅜-in. rolled steel angles and are secured to the side sill by means of bent angle clips. At the upper end they are riveted to the side plate and the end plate, which is of ¼-in. steel plate, shaped to suit the roof. There are two Z-bar end posts of 4-in. 12½-lb. section. Between the end posts, directly below the running board brackets, is placed a Wine shutter type ventilator. The steel car lines are riveted directly to the side plate.



Section at Crossbearer

The side lining is 1½-in. by 5⅛-in. tongued and grooved yellow pine bolted to the steel frame. Floor stringers of 5-in. by 3½-in. yellow pine are applied over the floor beams and crossbearers, extending continuously between the end sills, the sections at the bolsters being arranged as shown in the drawing. There are three stringers on each side of the car and to them is secured the flooring, which is 1¾-in. by 7¼-in. yellow pine, ship lapped. Two and one-quarter inch beveled grain strips are applied at the sides and ends.

The side doors, which have a clear opening of six feet, are constructed of 13/16-in. yellow pine, tongued and grooved, with a 13/16-in. pine frame. The outside frame and crossbar are steel angles. The doors are fitted with Camel Company door fixtures, including bottom rollers, door starter and burglar-proof lock. Handholds, ladders and sill steps are all in compliance with the requirements of the federal safety appliance laws and the standards of the American Railroad Association.



Arrangement of Stringers and Flooring at Bolster

Trucks

The trucks are of the rigid diamond arch bar type with 5-ft. 4-in. wheel base, having cast iron wheels and A. R. A. standard journal boxes. The bolsters are of cast steel with the center plate cast integral and are fitted with Stucki roller side bearings. The spring plank is pressed steel of channel section. Ajax No. 2 brake beams are used.

These cars were shipped on their own wheels, being sent to Key West over the Florida East Coast and transferred to Cuba on the car ferry operated by that road.

WHEN TO HEAT WOOD BEFORE GLUING*

Whether a hide glue joint will be strengthened or weakened by heating the wood before gluing depends on the size of the joint. If the joint to be made is of small area, heating the wood is unnecessary. In fact, it may be detrimental, for the warmth of the wood will keep the glue thin; and, when pressure is applied, too much glue may squeeze out, leaving a starved joint. It is easy to apply too much pressure.

In making glue joints of large size (several inches each way), heating the wood before gluing is of distinct advantage. Many experiments at the Forest Products Laboratory, Madison, Wis., have proved that when the wood in large joint work is not heated the joints develop full strength only in spots. Weak spots and even open joints are too frequently discovered. Uniform high strength in joints of large size may be secured by heating the wood in a hot-box for 10 or 15 minutes at 120 to 130 deg. F. just before gluing. The heat from the wood prevents the glue from chilling.

It should be remembered that heating the wood retards the setting of the glue to some extent. In heavy woods, from which the heat escapes slowly, this retarding effect is more marked than in lighter woods. In all species glued cold at the laboratory the time under pressure required to develop full joint strength was less than eight hours. When heated wood was used at least 10 hours were required to develop full joint strength in mahogany, and over 12 hours in oak and maple.

*Technical note No. 92, Forest Products Laboratory, U. S. Forest Service, Madison, Wis.

THE INSPECTION OF FREIGHT EQUIPMENT

Special Conditions Affecting the Loading of Cars and the Handling of Fast Freight Trains

BY L. K. SILLCOX

Assistant General Superintendent Motive Power, Chicago, Milwaukee & St. Paul

TO THE END that non-serviceable cars be kept off our line, car inspectors at interchange points will be careful to see that foreign cars coming from connecting lines are in good running order and otherwise fit for loading for which cars are intended.

When system cars are received in interchange with wrong repairs, car foremen will arrange for joint inspection being made and a joint evidence card being properly filled out and signed. This joint evidence card is to be forwarded to the master car builder's office with a bill, to cover correction of the wrong repairs. If the wrong repairs are not corrected at the time, the joint evidence card is to be securely tacked to outside face of the intermediate sill or on the cardboard on the center sill of all-steel cars. When wrong repairs are finally corrected the card may be removed and attached to a bill and forwarded immediately to the master car builder's office.

Cars Placed for Loading, Inspection and Repairs

It is of special importance that careful inspection be given and proper repairs made to cars before they are placed for loading to insure their being in good serviceable condition, as it should not be necessary to shop cars out under load before arriving at destination for defects that existed before being loaded. It is felt that no reasonable excuse can be given for placing a defective car for loading.

Light Repair Cars

When freight cars are shopped out for repairs, those needing the lighter repairs should be placed on repair tracks designated for such repairs so they will be promptly repaired and returned to service.

Marking Cars to the Repair Tracks Unnecessarily

In going over the railroad, it generally appears that at certain points insufficient attention is given light repairs to cars in yards. Many such cars when not handled in the yard are marked to the repair track, which is not only costly from a transportation standpoint, but also delays equipment and inflates the bad order statement.

It should be impressed upon all concerned that wherever possible, light repairs to cars should be made in yards and equipment ought not to be marked to the repair tracks for brake shoes, brake rods, packing, brasses, etc., when there is any possible way of doing this in the yard under blue flag protection.

When cars are shopped out by inspectors for minor repairs that can be made in transportation yards, the needed force should be provided so the cars can be promptly repaired, avoiding the necessity and cost of switching them to shop tracks.

The importance of this cannot be brought forcibly enough to the attention of all concerned. Certain stations show a sad lack of understanding in this direction. It should also be borne in mind that the journal box lids on freight trains must be opened at the principal inspection points, not only the lids on boxes that are easy to open, but also those that are more difficult. It means much to know whether the lubrication of the equipment is in fit condition and unless this precaution is taken there is bound to be continued difficulty.

Disposition of Unfit Cars

Instructions are issued giving automatic disposition and limit of expense for system owned freight cars. Unfit cars which come within the limits prescribed must be held for disposition as indicated and in order to show the true condition of affairs, the back of the No. 55 telegraph report is to contain the numbers and initials of foreign and system cars held for advice as to destruction or rebuilding. It is not economy to allow old unfit cars to continue in service causing good equipment to be damaged and broken up, and therefore these rules must be given the attention they deserve. Proper report of all cars destroyed or exchanged from one class to another must be made up as prescribed.

Shopping of System Freight Cars

It is not desired to ship bad order cars from one repair point to another, and no cars must be sent forward from one repair station to another without receiving written authority from the master car builder, assistant master car builder, or respective district general car forman's office. Violations of this rule will not be tolerated. Where bad order cars are sent from one station to another, they must be held on the originating station's bad order report, until such time as advice is received from the destination point, that they have received and will carry the cars. As a general rule, and in order to properly arrange material requirements, it is our practice to give preference to shipping system equipment in the following manner, concentrating on certain types to regularly meet the business:

January-February—Cabooses, Bunk Cars, Refrigerators.
March-April—Stock and Flour Cars.
May-June—Grain and Stock Cars.
July-August—Coal, Cinder and Merchandise Cars.
September-October—Logging. Flats and refrigerator Cars.
November-December—Ballast and Ore Cars.

Commodity Cards

The general practice of employing the use of commodity cards and boards is not wholly satisfactory unless very closely supervised. After cars have been loaded, these cards or boards should be removed as many suits for damage claims have been filed on the basis of information shown on rough freight cards or a leaky roof sign. Agents should be interested in giving this matter proper attention, also in removing explosive signs or cards when cars are emptied.

Obtaining Disposition of Foreign Equipment

It is intended that empty foreign cars in bad order on the railroad and which it is not considered advisable to repair, be written up for disposition promptly. Material required from owners for repairs to foreign cars on the railroad must be ordered just as quickly as possible so as not to hold cars unnecessarily. If action is not obtained within a 30 day period on either of the above items, and it causes any foreign car to be held in bad order more than 30 days, a telegram should be sent to the MCB office giving all particulars and data. If it happens to be that owners are dilatory the matter will be taken up with the executive of the owning line for immediate action. If cars stand around more than 30 days, let no effort be spared to get them moving.

Handling Charges for Repairing Foreign or Private Line Cars

Repairs of any kind to cars of foreign ownership, whether railroad, or privately owned, will be charged for in accordance with American Railroad Association rules, the latest price instructions to govern, all covered by the usual repair card. On cars of private ownership, or in cases where owners are not members of the association, charges will be made at actual cost and collection will be made by the agent, a complete record being kept and full advice sent to the master car builder in all cases so that proper accounting of these amounts may be insisted upon. In case repairs have to be made at any station where emergency trucks are not located, the necessary material will be obtained from the baggage car, or failing in this, such parts as desired can, if practical, be removed from the rear end of the rear car temporarily.

Transferring Bad Order Loads

Car foremen at all repair points will be considered the proper parties for authorizing the transfer of lading on any bad order car that cannot be repaired under load. Where additional help is required in order to carry out such transfer of lading, car foremen will take the matter up by wire, with the general car foreman or their immediate superior, stating necessity in detail. The higher officer in turn will request the superintendent to furnish the required number of men. This contemplates the entire abandonment of agents' forces or transferring being handled by contractors at any point on the system.

At the smaller stations, in case transferring is required on a valuable shipment, such as furniture, merchandise, machinery or finished and manufactured products, car foremen will call on the agent to break the seal and be in a position to verify that no unnecessary damage is done in the operation of transferring.

A weekly report of freight cars transferred or lading adjusted, must be made to the master car builder's office every Saturday night, and a copy sent to the general supervisor of transportation.

Line Clearance Diagram

The proper diagram should be posted at all inspection points for the instruction of inspectors, giving maximum clearance for loading which should be regarded with reference to offering cars in interchange at connecting points, also at originating points of loading. There has been a great deal of difficulty on account of being obliged to transfer loads on account of equipment not having proper clearance.

The car department must co-operate with agents on the system to the extent of cautioning them not to accept shipments wherein the clearance exceeds that stated. Agents will be able to check this matter to their own satisfaction, inasmuch as they are informed as to routing and billing.

All car foremen should co-operate to avoid having to transfer cars at connections on account of the limitations called for being exceeded and all should interest themselves in this matter. In case of doubt, the maximum clearance to pass all lines is a height of 12 ft. 6 in. and a width of 9 ft. 6 in., but most lines have a maximum height clearance of about 15 ft. and a width of 10 ft. 3 in.

Height to Load Grain in Cars

The following data have been worked up to show the maximum height to which a car may be loaded with grain depending on its inside length and width, based on the following weights:

Grain	Weight per Bushel, lb.
Wheat	60
Corn, rye or flax	56
Barley	48
Oats	32

30 Ton Capacity Cars 8 ft. 6 in. Wide Inside

Length inside	Wheat	Corn, Rye or Flax	Barley	Oats
31 ft. 0 in.	4 ft. 9 in.	5 ft. 1 in.	6 ft. 0 in.	8 ft. 0 in.
32 ft. 0 in.	4 ft. 7 in.	4 ft. 11 in.	5 ft. 9 in.	8 ft. 7 in.
33 ft. 0 in.	4 ft. 8 in.	4 ft. 9 in.	5 ft. 7 in.	8 ft. 4 in.
34 ft. 0 in.	4 ft. 4 in.	4 ft. 8 in.	5 ft. 5 in.	8 ft. 1 in.
35 ft. 0 in.	4 ft. 2 in.	4 ft. 8 in.	5 ft. 3 in.	7 ft. 10 in.
36 ft. 0 in.	4 ft. 1 in.	4 ft. 5 in.	5 ft. 1 in.	7 ft. 8 in.
37 ft. 0 in.	4 ft. 0 in.	4 ft. 3 in.	4 ft. 11 in.	7 ft. 5 in.
38 ft. 0 in.	3 ft. 11 in.	4 ft. 1 in.	4 ft. 10 in.	7 ft. 3 in.
39 ft. 0 in.	3 ft. 10 in.	4 ft. 0 in.	4 ft. 8 in.	7 ft. 1 in.
40 ft. 0 in.	3 ft. 8 in.	3 ft. 11 in.	4 ft. 7 in.	6 ft. 9 in.
41 ft. 0 in.	3 ft. 7 in.	3 ft. 10 in.	4 ft. 5 in.	6 ft. 7 in.
42 ft. 0 in.	3 ft. 8 in.	3 ft. 9 in.	4 ft. 4 in.	6 ft. 6 in.

40-ton Capacity Cars 8 Ft. 8 In. Wide Inside

36 ft. 0 in.	5 ft. 5 in.	5 ft. 9 in.	6 ft. 9 in.	10 ft. 2 in.
37 ft. 0 in.	5 ft. 5 in.	5 ft. 9 in.	6 ft. 9 in.	10 ft. 2 in.
38 ft. 0 in.	5 ft. 1 in.	5 ft. 6 in.	6 ft. 5 in.	9 ft. 8 in.
39 ft. 0 in.	5 ft. 0 in.	5 ft. 4 in.	6 ft. 3 in.	9 ft. 5 in.
40 ft. 0 in.	4 ft. 11 in.	5 ft. 3 in.	6 ft. 1 in.	9 ft. 1 in.
41 ft. 0 in.	4 ft. 10 in.	5 ft. 1 in.	6 ft. 0 in.	9 ft. 0 in.
42 ft. 0 in.	4 ft. 9 in.	5 ft. 0 in.	5 ft. 10 in.	8 ft. 9 in.
43 ft. 0 in.	4 ft. 8 in.	4 ft. 10 in.	5 ft. 9 in.	8 ft. 7 in.
44 ft. 0 in.	4 ft. 7 in.	4 ft. 9 in.	5 ft. 7 in.	8 ft. 5 in.
45 ft. 0 in.	4 ft. 4 in.	4 ft. 8 in.	5 ft. 5 in.	8 ft. 3 in.
46 ft. 0 in.	4 ft. 3 in.	4 ft. 7 in.	5 ft. 3 in.	8 ft. 0 in.
47 ft. 0 in.	4 ft. 1 in.	4 ft. 6 in.	5 ft. 2 in.	7 ft. 10 in.

40-Ton Cars 8 Ft. 2 In. Inside

Length inside	Wheat	Corn, Rye or Flax	Barley	Oats
38 ft. 0 in.	5 ft. 3 in.	5 ft. 9 in.	6 ft. 7 in.	8 ft. 10 in.
37 ft. 0 in.	5 ft. 1 in.	5 ft. 6 in.	6 ft. 5 in.	9 ft. 7 in.
38 ft. 0 in.	5 ft. 0 in.	5 ft. 4 in.	8 ft. 3 in.	9 ft. 5 in.
39 ft. 0 in.	4 ft. 11 in.	5 ft. 9 in.	8 ft. 1 in.	9 ft. 3 in.
40 ft. 0 in.	4 ft. 9 in.	5 ft. 1 in.	5 ft. 11 in.	9 ft. 0 in.
41 ft. 0 in.	4 ft. 8 in.	4 ft. 11 in.	5 ft. 10 in.	8 ft. 10 in.
42 ft. 0 in.	4 ft. 6 in.	4 ft. 10 in.	5 ft. 8 in.	8 ft. 8 in.
43 ft. 0 in.	4 ft. 5 in.	4 ft. 8 in.	5 ft. 7 in.	8 ft. 6 in.
44 ft. 0 in.	4 ft. 4 in.	4 ft. 7 in.	5 ft. 5 in.	8 ft. 4 in.
45 ft. 0 in.	4 ft. 3 in.	4 ft. 6 in.	5 ft. 4 in.	8 ft. 1 in.
46 ft. 0 in.	4 ft. 2 in.	4 ft. 5 in.	5 ft. 3 in.	7 ft. 10 in.
47 ft. 0 in.	4 ft. 1 in.	4 ft. 4 in.	5 ft. 1 in.	7 ft. 7 in.

50-Ton Cars— 8 Ft. 6 In. Wide Inside

36 ft. 0 in.	6 ft. 9 in.	7 ft. 3 in.	8 ft. 6 in.	12 ft. 8 in.
37 ft. 0 in.	8 ft. 7 in.	7 ft. 0 in.	8 ft. 2 in.	12 ft. 5 in.
38 ft. 0 in.	6 ft. 6 in.	6 ft. 11 in.	7 ft. 11 in.	12 ft. 2 in.
38 ft. 0 in.	6 ft. 3 in.	6 ft. 9 in.	7 ft. 9 in.	11 ft. 10 in.
40 ft. 0 in.	6 ft. 1 in.	6 ft. 7 in.	7 ft. 7 in.	11 ft. 6 in.
41 ft. 0 in.	6 ft. 0 in.	6 ft. 6 in.	7 ft. 6 in.	11 ft. 4 in.
42 ft. 2 in.	6 ft. 10 in.	6 ft. 5 in.	7 ft. 5 in.	11 ft. 1 in.
43 ft. 0 in.	5 ft. 9 in.	6 ft. 3 in.	7 ft. 4 in.	10 ft. 8 in.
44 ft. 0 in.	5 ft. 7 in.	8 ft. 1 in.	7 ft. 2 in.	10 ft. 4 in.
45 ft. 0 in.	5 ft. 5 in.	5 ft. 11 in.	7 ft. 0 in.	10 ft. 1 in.
46 ft. 0 in.	5 ft. 3 in.	5 ft. 9 in.	8 ft. 11 in.	9 ft. 11 in.
47 ft. 0 in.	5 ft. 2 in.	5 ft. 7 in.	8 ft. 10 in.	9 ft. 9 in.

50-Ton Cars—8 Ft. 9 In. Wide Inside.

38 ft. 0 in.	6 ft. 7 in.	7 ft. 1 in.	8 ft. 3 in.	12 ft. 6 in.

50-Ton Cars, 8 Ft. 9 In. Wide Inside

Length inside	Wheat	Corn, Rye or Flax	Barley	Oats
37 ft. 0 in.	6 ft. 5 in.	8 ft. 11 in.	8 ft. 1 in.	12 ft. 3 in.
38 ft. 0 in.	6 ft. 3 in.	6 ft. 9 in.	7 ft. 11 in.	12 ft. 0 in.
39 ft. 0 in.	6 ft. 1 in.	6 ft. 7 in.	7 ft. 8 in.	11 ft. 6 in.
40 ft. 0 in.	5 ft. 11 in.	6 ft. 4 in.	7 ft. 5 in.	11 ft. 1 in.
41 ft. 0 in.	5 ft. 9 in.	6 ft. 2 in.	7 ft. 2 in.	10 ft. 7 in.
42 ft. 0 in.	5 ft. 7 in.	6 ft. 0 in.	6 ft. 11 in.	10 ft. 3 in.
43 ft. 0 in.	5 ft. 5 in.	5 ft. 10 in.	6 ft. 9 in.	10 ft. 1 in.
44 ft. 0 in.	5 ft. 4 in.	5 ft. 8 in.	6 ft. 7 in.	10 ft. 0 in.
45 ft. 0 in.	5 ft. 3 in.	5 ft. 7 in.	6 ft. 6 in.	9 ft. 11 in.
46 ft. 0 in.	5 ft. 2 in.	5 ft. 6 in.	6 ft. 6 in.	9 ft. 9 in.
47 ft. 0 in.	5 ft. 1 in.	5 ft. 5 in.	6 ft. 4 in.	9 ft. 8 in.

Loading of Lumber on Open Top Cars

In the past there has been considerable trouble caused by carloads of lumber on flat and coal cars shifting, losing part of the load and making it necessary to set cars out to be re-staked and given considerable attention. This should be brought to the notice of agents and shippers should be advised that the M. C. B. rules governing the loading of lumber, piling, etc., on open top cars, must be carefully observed and cars must not be allowed to be forwarded in an unsafe condition. Stakes and wiring must be carefully examined and all precautions taken to see that there are enough of the stakes and that they are sufficiently strong to carry the load safely.

Inspectors must watch these shipments carefully and not allow a load to go forward until it is safe, and where one is found to be unsafe, it must be attended to properly, and a record taken as to where it was loaded and its destination, stating whether the staking, etc., is deficient so that the matter may be corrected at the initial loading point.

Bearing pieces, especially on wooden flat cars, must be placed over the bolsters, otherwise breakage of sills is bound to result.

Handling Gravel Ballast Cars

It is well to remember that open top cars loaded with sand and gravel become greatly overloaded in periods of rainy

weather. It has been determined that sometimes as much as 6,000 lb. additional load is encountered due to moisture absorbed and on this account all concerned are asked to guard in every reasonable way against overloading cars when such conditions prevail. System owned high side 30 ton gondolas are not to be used in gravel or ballast service, as they are not of suitable or strong enough construction.

Loading Ice in Refrigerator Cars

It should be thoroughly understood that in loading ice, refrigerator cars equipped with ice boxes must not be used in this traffic, owing to the damage resulting in the interior of the car.

Classification of Trains

A train may consist of an engine, or motor, or more than one engine, or motor, coupled with or without cars displaying markers.

A regular train is one authorized by a time-table schedule.

A section of a train obtains when running one or two or more trains on the same schedule, displaying signals, or for which signals are displayed.

An *extra train* is one not authorized by a time table schedule. It may be designated as—*Extra* for any extra train, except work extra; *Work Extra*—for work train extra.

There is in general a broad classification of trains constituting first class, which are passenger, second class, which are time freights, and third class, which are way freights. All extra trains and those for work service fall into their proper classification automatically.

Time Freight Runs

The success of a road as a freight-carrying line depends almost entirely on its reputation and ability to keep time freights close to their schedule. With this end in view, their movements have been specially plotted, showing the stopping points and standard classes of inspection required. Much depends on the careful planning of all men along the line, for there is hardly a single town of any size on the system which does not receive and supply loaded cars entering into the movement of time freight trains. It is only natural to suppose that the operating department are very anxious at all times to get these trains out of town and on their way with as little delay as possible. Foremen will be held responsible for seeing that cars are properly repaired at loading platforms, industries, etc., bad ordering such cars exhibiting serious defects and which cannot be fixed up in time to let them out for movement as intended on this account. Foremen should make such arrangements as to see that these cars when discovered are not loaded out, but sent empty to the repair track for attention. It is not a difficult matter to anticipate the movement of loads coming from connections, which are to form part of important time freight runs. Many times the shipment reaches us with a lot of delay, which must somehow be wiped out and shippers keep wiring us for delivery. All that we can do is to see that prompt businesslike attention is accorded. It is often very aggravating to have large parts of important trains turned over from connections requiring wheel renewals, repairs to air brake equipment, defective trucks and draft rigging. Some of this is due to rough handling through large terminals, or it may be that weak equipment has been employed. No loaded cars for important movement are allowed to proceed from gateway terminals, unless the following requirements are met, with this exception, that short draft timber cars, if loaded, may be placed to the number of ten per train ahead of the caboose. (A) If draft timbers are used they must extend at least 30 in. behind the center of the bolsters. (B) Cars having steel center sills running from end to end of car are satisfactory. (C) Cars of steel underframe, steel frames or all metal construction are satisfactory. (D) Cars having short draft timbers in front of body bolsters must have the load transferred at gateway terminals and, if possible, the car is to be disposed of to the delivering line in a satisfactory manner, unless it is known that the car can be kept not more than ten cars ahead of the caboose, for the entire movement.

Too much cannot be said with respect to the importance of small repair stations along the line, watching diligently to see that unfit cars or equipment which has not received adequate attention are put in proper shape before being placed in important time freight trains. If the cars cannot be made suitable for the movement, they should not be released until the load is transferred, in the regular manner, as has been described.

Steel Trains, Silk Runs and Other Trans-Continental Movements

It often happens that there are special runs lasting for long periods, of commodities destined for export at the Pacific Coast, or imports coming from the Orient, Alaska and other parts of the world, or of similar character on other railroads than those operating in the northwest. These shipments are only maintained on our railroad to the extent of our being able to render better service than our neighbors. The secret of success in handling of such movements is to first know the characteristics and requirements of the service and to put the equipment in proper condition to start with so that it can make a successful run to its destination without a lot of delay intermediately due to defects which should have been previously discovered.

Logging, Lumber, Ice and Ore Trains

This type of train movement is more or less localized and yet important, in maintaining the good will, and necessarily the patronage, of the communities served. The requirements of service at the various points on the system are well known to local foreman. An active effort is absolutely essential and must be made at all times to keep the equipment in good shape to handle the business offered and avoid delays and disaster. Equipment in such service must be given periodical attention.

Meat, Fruit, Produce and Dairy Trains

Possibly the greatest problem in the movement of scheduled freight runs comes under these classifications. In the first place, the equipment going to make up these trains, makes more mileage than any other type, as it is kept in constant service; and this has a very definite effect on the ability of truck frames, wheels, and axles to withstand breakage due to fatigue of metal and crystallization. Boxes run hot due to the high speed maintained and the rocking load, especially in beef cars which, coupled with heavy superstructures, imposes tremendous strains on the running gear. The greatest possible temptation prevails to absorb lost time, often with disastrous results, for most of the shipments are of very perishable nature, and time is consumed not only in icing the equipment, but, in routes from California to New York in fruit runs, it is reasonable to suppose that many unforeseen conditions have to be met, not only operating, but mechanical and climatic. Experience has dictated a policy of starting the trains out in the best possible condition and all necessary repairs to be made at intermediate points, also where time is not allowed to give proper attention to defects, good judgment would dictate the cutting out of the car—and this must be done rather than take any chances. A careful check must be made to see that equipment in this service is not overlooked. The greatest pride should be centered in handling this difficult class of business promptly, successfully and safely. Wherever it can be arranged, cars must be gone over before being set for loading or at the time loading is going on.

Stock Trains

Certain sections of the railroad depend entirely, or, in a large part, on the ability to attract stockmen to ship over the line. Very certain and difficult competition has to be met. Besides this, one of the greatest opportunities offered for damage claims is accounted for from delay in getting stock to market on time, resulting in changing prices offered for stock at the primary markets, also delays mean extra feeds which burden the shipper with unwarranted expense. Defective equipment offered for loading should always be avoided, as there is plenty of time to fix stock cars properly during the idle season and at feeding stations, where they must necessarily lay five hours at least. This is a branch of the trade where we must deliver service, as the shipper has his representative on board to check up the movement.

The Federal law prohibits the movement of stock when such movement exceeds 36 hours, unless stock is unloaded for rest and feeding. It is therefore of the utmost importance that stock cars be given the best attention at originating stations and at feeding stations, so that the trains will be able to make their next stop without being delayed on account of defective equipment. The minimum layover at feeding stations is five hours.

Movement of stock trains is checked by government representatives, and in cases where the 36 hour law is violated, suits are brought against the road.

Primary movements will find their way to the stations, where the principal packing houses are located. Local car foremen are well acquainted with the necessities of the cars and must not only take into account movements which come to them from their neighboring foremen, but should take sufficient interest to see that when cars are returned they go into the loading territories in good order. In this sense the foremen can control their bad order situation and difficulties of movement through their territory to a very great extent. Too many foremen complain about their neighbors when they themselves had the same empty stock cars passing through their stations prior to being loaded and prior to returning to them in unfit condition under revenue load and allowed the cars to pass through their hands in defective condition and return in the same shape, necessitating delay to trains and oftentimes transfer of shipments. Further emphasis is necessary to point out that at feeding stations the minimum time allowed is five hours and the time between feeding stations is very much limited, due to shippers being unwilling to delay their stock and to go to the additional expense of extra feeds, which can be overcome if these trains are put in shape during the five hours allowed during the rest period. This must be done, and feeding stations are primarily responsible for the 36 hour movement of trains between feeding stations and consuming markets.

Work Trains

Proper co-operation and understanding with the operating department will do ever so much in providing for successful operation of work, gravel and ballast trains. Sufficient notice should be given in advance, so that opportunity may be taken to put cars in shape. Care should be exercised to be certain that the proper type of car is furnished; for instance, ballast cars should not be used where flat cars are wanted, resulting in the sides of ballast cars being torn off and wrecked, as has been done often in the past. Center plates should be well lubricated, side bearings free of each other, draft gear, brake and wheels in good order and lubrication, packing, brasses, wedges, boxes, covers and dust guards in perfect condition to render effective service. Overloading of cars is to be avoided.

Inspection of Trains

It is the duty of inspectors to see that the coupling pipe joints and all other parts of the brake apparatus are in good order and free from leaks. For this purpose they must be tested at every opportunity and especially when air pressure is available. If a defect is discovered in the brake equipment of a car which cannot be held long enough to give time to correct such defect, the brake must be cut out and the car properly carded to call the attention of the next inspector to the repairs required, but, as stated elsewhere, the carding of this brake must be the last resort and every effort should be made to repair the defect before the car is allowed to proceed.

The smallest proportion of freight cars with the air brakes in good condition must be 85 per cent. In making up trains the couplings must be united and the cocks at the ends of the cars all open, except at the rear end of the last car, where the cock must be closed. The inspector must know that the air is passing through the pipes to the rear end and that the couplings are properly connected and free from leaks. After the train is fully charged, the engineer must be signalled to apply the brakes. When the brakes have been applied, they must be examined upon each car to see that they are applied and have the proper piston travel. This having been ascertained, the inspector must signal the engineer to release the brakes. He must then again examine the brakes upon each car to note that each is released. If any defect is discovered, it must be corrected and the testing of the brakes repeated until they are found to work properly. The inspector must then enter on form 975 the number of cars with brakes in good order. This examination must be repeated if any change is made in the make-up of the train before starting.

Inspectors should especially take advantage of the incoming freight terminal test as this is the logical time to locate the defects as they will then have ample time to repair them. When the engineer applies the brakes and then cuts off, the inspectors must make a rapid inspection of piston travel, marking on the side of the car with chalk those cars which have either short or long travel, but not stopping to adjust the brakes or make any other repairs at this time, making all necessary adjustments on the way back. In many yards where a train is made up the outgoing engine is not coupled on until the time of departure. When this occurs everyone is in great haste to get this train out of the yard and in many cases the air brake inspection is neglected, but this can be overcome to a great extent if after a train is made up and the switching is all done, air from a switch engine is secured to charge up this train. If this is done, when the outgoing engine is coupled on, there will be nothing else to be done but to charge up the brakes and then leave.

Train Release Inspection Certificate

The object of this form is to guarantee the proper inspection and safe condition of the equipment and to obtain the benefit of the train crews' experience with the trains while on the road. Any defects shown on this form must be properly corrected and the car inspector at the inbound station is to make certain that ample assistance is provided to correct any of the defects reported by the conductor on this form so that it will not be necessary for him in filling out this form for the outbound movement of the train to include any of the defects previously reported. This form is to be made out in duplicate, and the car inspector will hand the conductor in charge of the train leaving the station two blanks with carbon paper between, all placed on a suitable board and of same dimensions as the report and held in place by a rubber band near the top. On arrival of the train at the inbound station, the car inspector will meet the conductor and receive Form 975 and will note thereon the number of brakes cut-out and sign the report in the space provided for inbound movement signature. He will at this time note whether the brakes cut-out have air

brake defect cards attached. He will also look over the report to see whether the conductor has reported any difficulty with the train while in his possession and if any trouble is reported it must be corrected immediately. The original of the report must then be forwarded to the division superintendent and the duplicate retained by the local car foreman in charge of the station at which the train arrives. These copies must be kept in neat order so as to be readily accessible in the event it is desired to look up the record on any train arriving at the station. It should be understood that these reports are to be used on all divisions and are to cover the operation of a train from one terminal to the next terminal and where a train goes through several terminals, the car inspector will arrange to supply new forms to the conductor taking charge of train leaving station. In other words, the one form is not to be carried through from the originating station to the final terminal, but is to be carried only so far as each divisional terminal where train crews change.

Carding Cut-Out Brakes

The applying of air brake defect cards to cars on outgoing trains by inspectors must be the last resort. The necessary repairs must and can be made if the inspection is made at the proper time, i.e., on the arrival of trains. This defect card is primarily for the use of trainmen who oftentimes encounter a brake, while en route, that is causing them trouble and their only resource is to cut this brake out to enable them to get over the road. In order to expedite all repairs on this brake, they are furnished with an air brake defect card which they should attach to the crossover pipe, marking on this card the reason why the brake was cut out. On arrival at the terminal the inspectors and repair men must make every effort to repair the defect as carded. The only time when an inspector will be permitted to allow a car to proceed with the brake cut out and a defect card attached will be when under no circumstances could this car be held to make the necessary repairs, such as in manifest freight service. Cars arriving in yards with brakes cut-out and no cards attached should be reported to the foreman in charge who in turn will take this matter up with the division superintendent as it is imperative that anyone cutting out a brake for any reason whatever should apply an air brake defect card properly filled out as to the defect for which it was cut out.

Hot Boxes on Incoming Trains

As a general rule, car equipment coming in on time freights, or otherwise, having hot boxes, should be given immediate attention to avoid the entire destruction of the packing, dust guards and journal, due to continued burning of the waste. Under these circumstances, the packing should be removed immediately when discovered and the journal jacked up and allowed to cool so that the work can be done on the train while the box is cooling off and inspectors return and finish the job without having to switch cars out. It very often happens that cars are marked out for cut jurnals under these circumstances, when this is not a fact, and a large saving in expense can be obtained through diligent following up of the work along the lines described. All packing when pulled out should be placed in a suitable pail or metal receptacle and not thrown on the ground.

Method of Treating Hot Boxes En Route

In stating the method of treating hot boxes enroute, for the information of train crews, the following should be remembered: As prepared packing and tools are assigned as a part of the train equipment, they should consist of a standard bucket, packing iron and hook. Trainmen should see that the packing is protected from dirt and water.

It should be the duty of the trainmen when taking cars at points where there are no car inspectors to examine the journal boxes and see that they are in proper condition for safe movement. A little time and attention may save the annoyance of a hot box and serious detention to the train.

When there is evidence of a journal heating, open the box lid, insert the packing hook along the journal to ascertain if the packing is in contact with the journal for its entire length and that the journal is not cut. If the packing is not in contact with the journal and the journal is not cut, add fresh packing, if necessary, or raise the packing in the box, so that it may have proper contact with the journal. If it continues to heat, a new brass should be applied.

In applying a new brass, first remove the packing from the box, placing it in a bucket, or in some other manner protecting it so that it will not come in contact with the ground; then jack up the box. Frequently, when jacking up the box, the wheels will rise from the rail, holding the brass and wedge against the crown of the box. A block placed from the top of the wheel to the sill of the car will prevent this. When the brass and wedge are free from weight, insert the packing tool along each side of the brass and pull the brass and wedge forward out of the box; this to keep the brass from turning to the underside of the journal and dropping to the bottom of the box. Packing removed from the journal and not used in the repacking of the box should be returned to the point designated by official order on the respective divisions.

When water is used for cooling, the journal should not be cooled to a low temperature and water should not be used until the brass has been renewed. Notice should be given at the end of the run at the point of cut-out, if the car is cut-out, that the journal has been cooled by water, in order that it may be removed at the first opportunity.

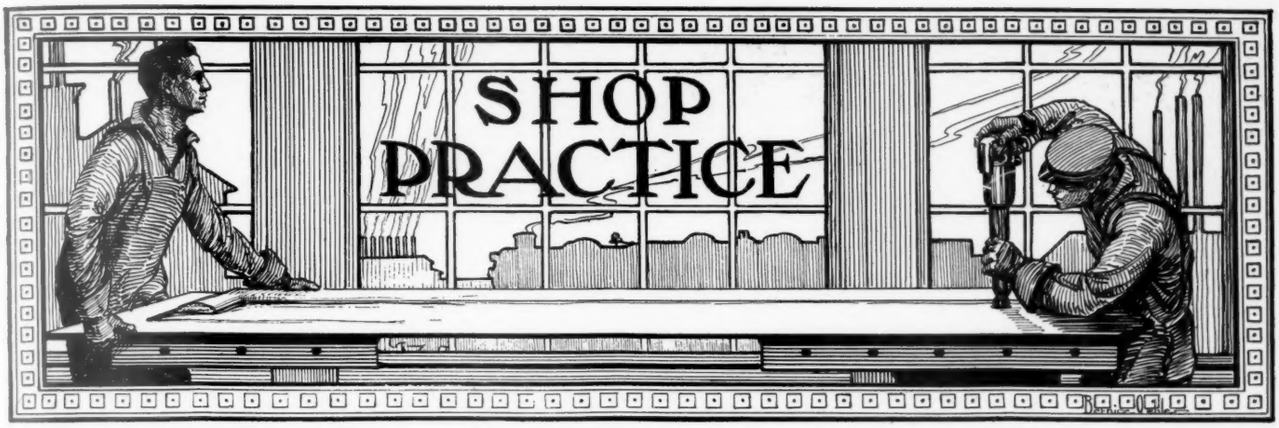
Carefully examine the journal with the packing hook to determine rough or cut places. The condition of the journal should be mentioned on the report of hot boxes. Before applying a brass, place the wedge on it and note that the wedge rests on the crown of the brass with some clearance on the sides.

To determine the fit of a journal, cover the surface of the brass with a thin coating of oil, which should be squeezed from the packing, and place the brass on the journal, moving it back and forth a few times. Then remove it carefully and if the face shows that it bears on the edges of the brass, the brass is too small in radius, which would cause it to heat. If the brass bears along the crown for its whole length and from 1½ to 2 in. in width and clear of contact at the edges, it is of proper size. The face of the brass should be oiled before applying, by squeezing oil from the packing.

Apply the wedge on top of the brass after the brass has been placed on the journal and be sure that the wedge is back in proper position and not resting on the lugs which hold it in position in the crown of the journal box. In lowering the journal box, be sure that the wedge and brass are properly seated.

If the car having a hot box is set off at a siding, or brought into a terminal, the box should be plainly marked by the trainmen in the absence of an inspector. This mark must remain thereon until removed by the car inspector or repairer after the box has been properly cared for. A box thus marked will indicate to the car inspector or repairer that it has given trouble on account of heating and requires attention.

Lignite Briquettes, manufactured from natural coal tar and lignite from Alberta, Canada, coal mines, will probably be placed on the market before another year. Government experts are working on a solution to extract tar from the extensive sands of Alberta, with a view to using it in the manufacture of briquettes.—*The Engineer, London.*



EXPERIMENTS WITH LATHE TURNING TOOLS

In a paper recently presented before the Institution of Mechanical Engineers George W. Burley described a series of experiments covering certain points relating to the cutting qualities and efficiency of lathe turning tools made in the machine tool laboratory of the University of Sheffield. As a result of these experiments the following conclusions were reached:

1. There is no practical cutting speed below which it is impossible to obtain a satisfactory surface on plain carbon steels by means of ordinary lathe finishing tools, whether these be made of plain carbon tool steel, ordinary (non-vanadium) high speed steel, or superior (vanadium) high speed steel. There is, however, a maximum limiting speed above which a satisfactory finish cannot be obtained on account of the tendency of the tool to pluck at and tear the surface, this tendency being related to the phenomenon of building up on the cutting edge of the tool. For the finishing of mild steel this limit is not very different for each of the above three varieties of tool steel and is within the range of 48 to 58 ft. per minute. For the finishing of hard steel this limit does depend somewhat on the variety of tool steel which is employed and is within the ranges of 23 to 28, 17 to 21, and 28 to 34 ft. per minute for the three varieties of tool steel respectively.

2. The durability or life of a lathe finishing tool, whether of plain carbon or high speed steel, is for all cutting speeds below the limiting speed some function of the reciprocal of the cutting speed; in other words, an increase in the cutting speed below the limiting value is always accompanied by a decrease in the life or durability of the tool.

3. The most suitable angle of side rake (that is, the angle of side rake associated with maximum durability and cutting power) for a high speed lathe roughing tool working on steel depends upon the physical properties of the steel. For mild steel turning it lies between 20 deg. and 25 deg., while for hard steel turning it is of the order of 10 deg.; and if these angles are either increased or reduced there is always a depreciation of cutting power.

4. The color of the turnings formed by a high speed lathe roughing tool when working on steel is not necessarily a true index of the condition of maximum cutting efficiency. Thus, in the case of hard steel turning, the turning color which is associated with maximum cutting efficiency is a pale blue, while a mild steel turning which is removed under the conditions of maximum efficiency is practically uncolored, apart, of course, from the natural gray color of the steel.

5. The net power consumption of a high speed roughing tool is dependent, other conditions being constant, upon the amount of top rake on the tool, the relation between these two quantities being reciprocal in character, so that, within the limits of ordinary practice, a reduction in the top rake angles of a tool is always accompanied by an increase in the net amount of power consumed. The law connecting the variations of the two quantities appears to be of the nature of a straight line law for all qualities of steel machined. There are, therefore, no critical values of the rake angles in regard to power consumption as there are in regard to durability and cutting power.

6. The cutting power of a high speed lathe tool is influenced by both the cross sectional area of the shank of the tool and the nose radius, but the influence of the latter factor very largely predominates in all cases. Thus, with a number of different sections of tool steel, an increaase of the nose radius of 100 per cent produced an average increase in the cutting power of 45 per cent; whereas an increase of the cross section of the shank of the tool of 500 per cent with a constant nose radius produced an average increase in the cutting power of only 8.5 per cent.

7. The effect of raising a roughing tool so that its cutting edge is slightly above the horizontal plane passing through the lathe centers is, generally, to increase the cutting power of the tool slightly and to reduce its net power consumption slightly, when compared with its normal position, that is, with its cutting edge at the same height as the lathe center axis.

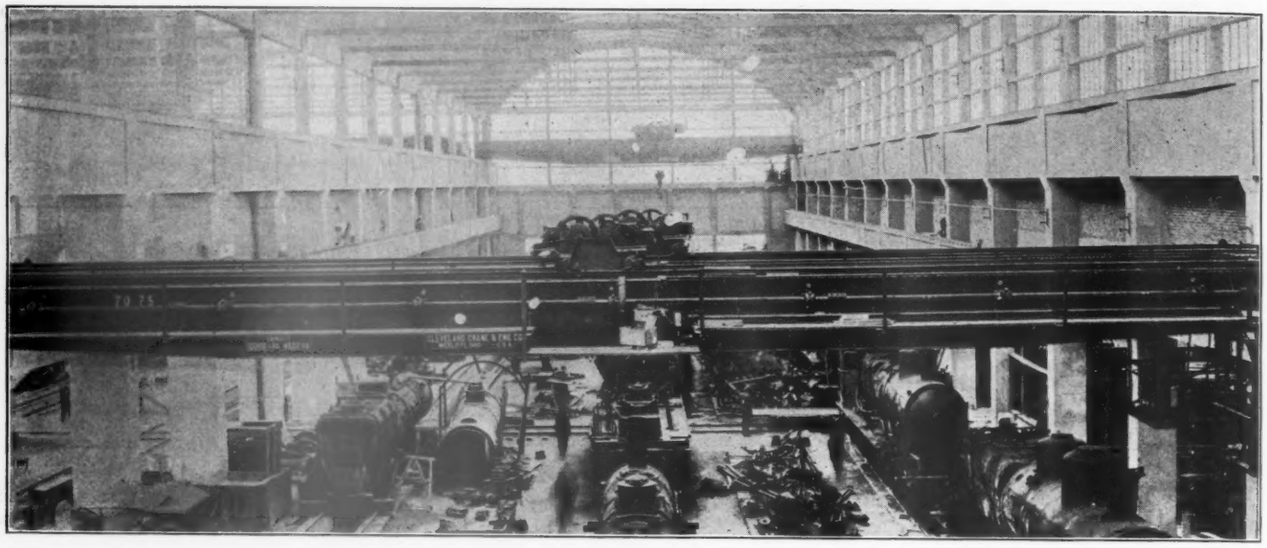
8. Forging the nose of a lathe cutting tool does not materially affect its cutting power and durability, there being practically nothing to choose between a completely ground tool and a forged and ground tool, otherwise identical.

9. The general direction and the active length of the cutting edge of a high speed tool have a slight influence upon the net power consumption of the tool, the influence being such that, with any given depth of cut, if the active length of the cutting edge is increased by an alteration of the general direction of the edge, the net power consumed is increased under conditions of working otherwise identical.

10. There is no marked difference in the net amounts of energy required per cubic inch of material removed from mild steel and hard steel bars at high and low cutting speeds.

11. The increase in the cutting power of a high speed roughing tool resulting from the use of a given stream of water as a cooling agent is greater with small cuts than with heavier ones, indicating that, with heavier cuts, heavier flows of coolant should be used. The velocity of flow of a stream of coolant does not very materially affect the improvement in the cutting power of a tool due to the use of the coolant, provided that the velocity is not such as to cause excessive splashing of the coolant.

12. The cutting efficiency of a high speed roughing tool depends very largely upon the condition of the cutting edge of the tool; and although a tool with its cutting edge blunted in the cutting process may continue to cut, it cannot be used in that condition for the purpose of starting a new cut.



Erecting Shop, Nevers, France

MECHANICAL TRADES SCHOOLS OF THE A. E. F.

Short Intensive Training in the Mechanical Trades Organized in France After Signing of the Armistice

BY MAJOR C. E. LESTER

THE experience of our army in the late war in Europe taught that in modern wars the need for men well trained in industrial service is as great as the need of men trained in combat service. In putting into the field an army of a million men the service of supply is the all-important factor in the army's success, and in this service there is need of men well trained in almost every mechanical trade to keep the service functioning properly. These facts were forcibly demonstrated in more than one instance and were the prime reasons for establishing schools of various kinds in the army both in France and in this country.

The steady and enormous demand for skilled men of all crafts and professions was never entirely met prior to the armistice and gave emphasis to the fact that our peace-time army, to be self-sustaining to any degree, should be given training in production as well as destruction and that serious consideration should be given to the establishment of schools in the service where not only engineer and air service troops but all combat troops, as part of their curriculum, would be given training in the various mechanical trades.

The mechanical trades schools of the intermediate section of the service of supply constituted a unique departure from all educational projects and have occupied an altogether distinct place in the training section of the army. They form such an unusual part of the vast educational program of the A. E. F., and are so unlike anything hitherto attempted in American education, that they may reasonably be expected to have an important bearing on the possible vocational training for the peace-time army.

In the combat divisions and wherever troops could be spared after the armistice, educational courses from local studies at the Y. M. C. A.'s and post schools to scholarships in French universities were provided. In surveying the possibilities of extending the plan, the educational commission developed the fact that in the intermediate section of the service of supply there were vast manufacturing and repair plants that might in some way be utilized for the education of several thousand men in the mechanical trades who, soon to be returned to civilian pursuits, could be assisted in more thoroughly fitting themselves for a peace-time occupation and who wished increased rather than lessened earning capacity as a result of their tour in the service.

Origin of Mechanical Trade Schools Plan

The following extract from the report made by Carlton Gibson of the educational commission and later director of mechanical trade schools of the intermediate section, will perhaps give the best exposition of the plan for utilizing the Nevers locomotive and car shops as a means of affording special mechanical mechanical training to 500 men from the combat divisions: "Credit is due to the general superintendent of the 19th Grand Division Transportation Corps for the scheme of utilizing the large railroad shops at Nevers, perhaps the most attractive and best equipped shops in all Europe, for training men in all trades related to railroad transportation, a very important branch of the service. The installation in these shops of all the best types of modern machinery gave to him the vision of tying the production work of the shop with the training of several hundred men selected from the armies, in machine shop practice, foundry work, oxy-acetylene welding, blacksmithing, pattern making and other mechanical trades.

As a result of this report the following schools were decided on and established within a period of three weeks:

Nevers—Railroad Shop.
Verneuil and Romarantin—Motor Reconstruction Park.
Gievres—Signal Corps Shops.
Mehun—Ordnance Shops.
Decise—Driver Mechanics School.
Sougy—Remount School and training in the various occupations of the plants.

The need for additional highly skilled men in Nevers shop had been a problem since its inception and my desires to understudy our good mechanics with earnest boys and men who desired to further their mechanical knowledge could not be wholly gratified due to scarcity of men particularly of de-

pendable men. I saw in the desire to give men of combat troops mechanical training an opportunity to augment my forces and increase production provided that we were not hampered by the interference of dictatorial officers who were unfamiliar with shop work, or annoyed by the commanding officers of men detached to our schools.

Unusual Conditions to Contend With

It was felt that could we be allowed to operate as before and handle the schools as we desired the students could be put on a productive basis, giving them the benefit of our best efforts in expert supervision and instruction and working with our most skilled men and in a few weeks' time increase production sufficiently to compensate, or nearly so, for the additional man hours expended. It was never felt that the signing of the armistice lessened our responsibilities and the maximum output obtainable was the figure for which we were striving. How well we succeeded is another story, however, I may say, that our output increased steadily in proportion to the hours expended from the armistice till cessation of operations in May, 1919. My one thought was to so co-ordinate the school and shop that the students would receive an intensive, intelligent and instructive course of training and we would get value received in a fair day's work each day.

It may not be inappropriate to say that while the schools were authorized by General Headquarters and sponsored by the educational commission and literature issued showing the advantages of the schools and inviting soldiers of the regular establishment to take up courses and ordering to the schools such as desired to go, the burden of developing the complete courses of study and work, the organizing of provisional companies, the problems of housing, feeding, clothing, and general welfare, the problems of assimilation, the selection of instructor personnel (technical and practical) fell to the superintendent of shops.

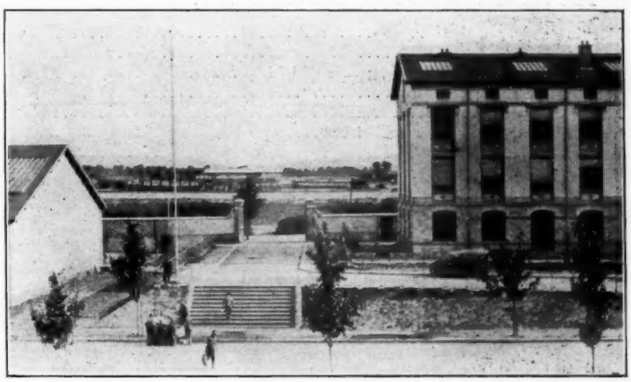
No outside assistance other than colored cooks and the administrative officers for the provisional companies was received and all duties other than these were detailed to officers of our organization in addition to their other duties. Provisional companies No. 1 and No. 2 were organized and selections from the student personnel were made to carry on the routine military duties, such as first sergeant, company clerk, platoon leaders, squad leaders, and fatigue. This work was required to be done in addition to the duties in the shop. The companies did no guard duty and no fatigue other than company but were required to stand reveille and participate in the daily short period military drill and regimental parade at retreat. This practice was inaugurated in February, 1919, for all shop men by reducing the shop hours to 8 and using one hour for drill and ceremony. This broke the monotony of the daily shop grind and assisted in keeping the men physically fit and mentally alert and gave to them the snap and set up common to veteran combat troops but seldom found in other branches of the service.

How the Work Was Organized

Immediately on obtaining information that the schools were to be established, time was taken by the forelock and a vocational officer was appointed to whose ability is due a great share of the credit for the successful operation of the schools. This officer was ably assisted by specially selected men that formed the body of the schools' instruction force. Text books were not available but we had the engineer corps field technical library as a basis to work on and developed courses of study for the several occupations before the arrival of the students. As developed, the courses were not elaborate, but included the fundamental facts and theories consistent with the trade concerned.

About the time that the schools were started it was learned that the 3 months' training period, as first planned, would of necessity be shortened by the plans to discontinue all operations not later than July 1, 1919. The scheme for utilizing one day for class room work was changed to give each student but ½ day weekly and the only subjects to be taught were shop arithmetic and applied practical mechanics. The former was a practical course in elementary mathematics with numerous applications to shop problems; the latter was intended to acquaint the student with the fundamental facts and theories of the science of mechanics which underlie all shop operations.

A course in elementary mechanical drawing was given to such students as were desirous of becoming draftsmen or those who desired to acquire a working knowledge of mechanical drawing. In addition to the practical shop work a series of lectures was arranged; these lectures to be given by various shop



Administration Building and Entrance to Shops

officers on subjects of interest to the students in various courses. This schedule was somewhat interfered with by ordering to the U. S. many of the officers concerned.

In view of the shortening of the schedule as originally planned it was felt that class room work and theory would have to be sacrificed for practical work to enable the student to have sufficient knowledge of shop practices to fit him for a position after his return to the U. S. A. and his discharge from the service.

The men enrolled in the school were from all branches of service in the A. E. F. the majority being from combat divisions. The following fighting divisions were represented: 1st, 2nd, 3d, 4th, 5th, 6th, 7th, 8th, 79th, 81st, 88th and 3d army headquarters.

Selection of the Student Personnel

As the men reported they were interviewed by the vocational training officer who obtained in addition to such information relative to the man as could be judged by a personal interview, the man's age, schooling, civil and army occupation and his preference in regard to proposed training. This information was recorded on a form and used in assigning students to their duties. In establishing of the schools it was felt that those who would desire to become students would be men somewhat above the ordinary caliber and that they could be put upon an honor basis and the schools run as a college. Prior to the opening of the schools all arrivals were addressed by the commanding officer on the subject of the proposed method of running the school and the duties of the officers in charge, the co-operation expected from the workmen and the duties of the student body. Prior to this all members of the old organization had been called upon to exercise every effort and sacrifice their own desires in order to assist those who apparently needed and wanted help.

It developed, however, that there were many reasons other than study and development that brought some of the students (so called) to the schools. Some thought that by getting into

the S. O. S. that their chances of returning home quickly were enhanced, some did not want to go into Germany with their outfit and others who expected they could get out of a few week's work. The honor system did not work out with such men and they were put on a strictly military basis. In justice to the student body as a whole they were men of good character and came with the fixed purpose of improving themselves.

The splendid equipment of the shops offered unusual opportunities for practical work in the metal trades and each department was headed by men of experience, well qualified as instructors. Due to many outfits being ordered home shortly prior to the opening of the schools April 1, 1919, many men were deprived of the opportunity of attending and but 267 actually reported.

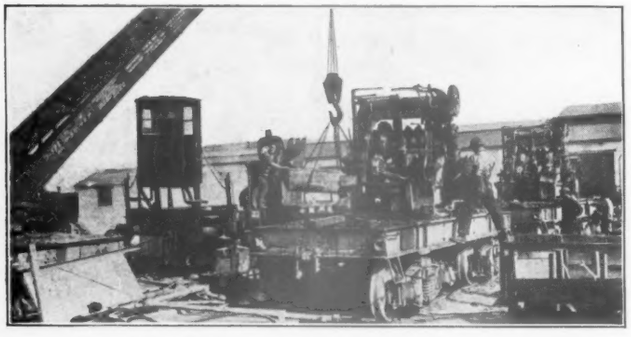
The students were assigned as follows:

Machine shop practice	82
Erecting Shop (Loco.)	48
Car repairing, wood working, pattern making	39
Sheet metal and pipe fitting	26
Electrical work	23
Foundry practice (Brass and iron)	19
Tool making and die sinking	10
Blacksmithing	13
Boiler Making	12
Autogenous and electric welding	5

Of the 82 men assigned to machine shop it was found that nearly 75 per cent had some previous experience such as running a drill press or working one particular kind of machine, and they desired to broaden their knowledge. Our machine shop was without question the most modern locomotive machine shop in the world. Every machine was the very last word in its kind, each having individual motor drive and of the latest model. The work in this department and tool room along the same lines was especially attractive to the students, more so than in any other department. Every effort was made to give the student the widest experience possible, which was considerable in a shop of this character.

Valuable Results Accomplished by School

The erecting shop offered many opportunities to the ambitious student to gather knowledge of the erection of locomotives of many designs. Locomotives built by the American and Baldwin locomotive works were assembled at Nevers as well as many types of Belgian, all types of French passenger locomotives, trench locomotives, "Economique" locomotives,



Erecting Locomotive Cranes

metre gage and German freight engines. Here one could by observation learn many things that it would be difficult to learn elsewhere. The car shop offered opportunities to men who had no previous training to pick up a trade (today rather lucrative) in a short time. This vocation is quickly and easily mastered.

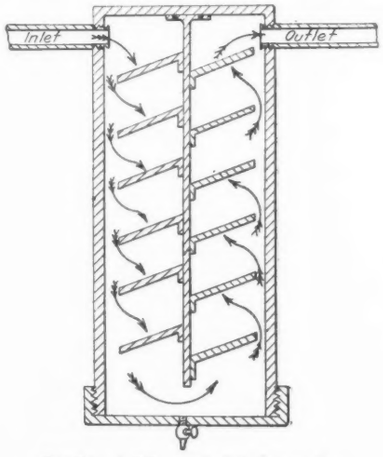
Practically all the foundry practice students were men who had some previous experience and grasped this opportunity to put themselves in readiness to accept a journeyman's job on discharge from the service. The same may be said of a large share of students in the sheet metal department.

The smith shop students were nearly all men who had been horse shoers or country blacksmiths and they all made enthusiastic students in the heavier railroad work with the steam hammers to assist. After the course was under way a card index system was developed to keep records of work done and the students' individual rating. The different department foremen and instructors were required to submit a weekly progress and rating sheet from which, with class room work included, the student's weekly rating was determined. Due to cessation of activities in the shops the schools were drawn to a close May 31, 1919, each student being furnished a certificate of studentship and forwarded to his organization or sent to an embarkation camp for return to this country.

The only regrettable thing in connection with our efforts was that the schools could not have a longer period of existence. Without doubt the men who took advantage of their opportunities of the mechanical trade schools of Nevers gained some valuable knowledge and experience to assist them in civil life that might have been doubly valuable with another few weeks' training.

SEPARATOR FOR COMPRESSED AIR LINE

In connection with the care and use of pneumatic tools the use of a separator to extract the oil and water from long pipe lines conveying compressed air is highly desirable. Some of the undesirable effects of oil and water accumulating in such lines were pointed out by H. S. Covey, secretary of the Cleveland Pneumatic Tool Company, in an address before the Railway Club of Pittsburgh, an abstract of which was printed



Sectional View of Oil Separator

in the *Railway Mechanical Engineer* of May, 1920, page 292.

The accompanying sketch shows a sectional view of the oil and water separator referred to by Mr. Covey in his address, as follows:

The separator consists of a 3-ft. section of 5-in. iron pipe, capped at top and bottom, and is attached to the branch air pipe lines which feed the drop pipes and hose lines. The air leaves the separator at the top, entering the branch outlet pipe attached to the cap at the opposite side to the inlet. The air is thus freed from oil and such water as may still remain in the system. The separator is drained of its accumulated water and oil through the drain cock provided at the bottom cap of the separator. Occasionally the lower cap of the separator should be removed and the baffle plates cleaned by means of a stream of compressed air which quickly removes the oil adhering to them.

Interesting Shop Employees in Shop Output

Simple Scheme of Displaying a Comparison of Man-Hour Production for Information of the Men

ONE of the most marked effects of the Railroad Administration operation of the railroads is the changed conditions which it has brought about in railroad shops. Piece work, which had very extensively been employed in car shops and to a considerable extent in locomotive shops, was abolished, rates of pay re-adjusted, helpers advanced to mechanics and many shops formerly working under non-union conditions, although now nominally open shops, have become practically 100 per cent unionized. In such shops the organization and operation of grievance committees has been an innovation to which both men and shop managements have had to adjust themselves. The result of all these changes has been a disturbance which has affected output, more or less seriously, in almost every railroad shop of importance in the country.

The changed conditions have required new measures on the part of the managements to bring production back to reasonably satisfactory standards. At one shop where, during the latter part of last year, a marked falling off in the man-hour output was being experienced an ingenious means of presenting a comparison of output by months of the current and preceding years in a form which could readily be comprehended by the men in the shop, was developed and employed with gratifying results.

The plan had its inception in a conference between the local shop committee, the shop officers and the superintendent

OUTPUT METER.

PERCENTAGE BASIS.

R 1	100	C 3	70	H	40
R 2	90	H 4	60	L	30
R 3	80	H 5	50	S	20

	APRIL 1919 WEEK ENDING 5.	12	19	26		APRIL 1920 WEEK ENDING 3.	10.	17.	24.	APRIL 1920. % GAIN. WEEK ENDING 3.	10.	17.	24.	APRIL 1920. % LOSS. WEEK ENDING 3.	10.	17.	24.	APRIL 1919 MEN EMPLOYED	APRIL 1920 MEN EMPLOYED	APRIL 1919 HOURS WORKED	APRIL 1920 HOURS WORKED
R	3	2	3		R	3	2	3			12%			9%		6%		602	555	40	54
C	1				C													REMARKS.			
H	2	2	1		H	3	6	5													
L	2	4	4		L	5	2	1													
S					S																
TOTAL ENGS					TOTAL ENGS					TOTAL %				TOTAL %							

1919.	ENGS. OUT	1920.	ENGS. OUT	1919. HOURS WORKED	1920. HOURS WORKED	1919. MEN EMPLOYED	1920. MEN EMPLOYED	% GAIN	% LOSS
JAN.	41	JAN.	38	208	234	592	600		18%
FEB.	26	FEB.	30	175	216	608	567		.03%
MAR.	30	MAR.	40	173	243	618	578	5%	
APR.									

Form of Board on Which Comparative Output Figures May Be Bulletined for the Inspection of the Men in the Shops

of motive power, at which the facts of the situation were laid before the committee. When confronted with a statement that the shop had actually suffered a decline in output the members of the committee were loath to believe that the situation was as represented. An inspection of the records of men employed, hours worked and locomotives turned out, however, convinced the committee, one of whom expressed the opinion that, if they knew them, no one would regret these facts more than the men in the shops and that if a means were available for laying before the men the month to month facts as to output they would remedy the situation themselves.

As the result of this conference the scheme here described for calculating and recording the month to month output on a comparative basis was developed.

In order that a reasonably satisfactory comparison of output might be made some method of weighting the various classes of repairs was necessary. This was worked out on a so-called point basis, each class of repairs being assigned a number of points such that the numbers assigned to the different classes of repairs would bear a relationship to each other approximating the relationship between the actual man-hours of labor required on the average locomotive going through the shop for the different classes. The following number of points have been assigned to the various classes of repairs:

Class 1 rebuild (new)	100
Class 2 rebuild	90
Class 3 rebuild	80
Class 3 general	70
Class 4 heavy	60
Class 5 heavy	50
Heavy	40
Light	30
Specific	20

This classification is posted at the top of the output meter board which is placed in the shop where it is accessible for the inspection of the men.

In order to eliminate the effect of possible variations in conditions from month to month, the comparison is made between each month of the current year and the same month of the preceding year. The comparison is expressed as a per cent loss or gain, as the case may be. A simple formula has been worked out for the calculation of this per cent and a blueprint copy of the formula is posted near the output meter board in order that the basis of comparison may be generally understood. The first step in the calculations is the determination of the aggregate number of points equivalent to the output for the month. With a knowledge of the number of locomotives in for each class of repairs which was turned out during the month, this is readily determined by referring to the percentage or point basis just described. The next step is the determination of the total man-hours worked, which is the number of shop hours for the month multiplied by the number of men employed. The basis of comparison is then arrived at by dividing the total number of man-hours worked by the number of points, giving the number of man-hours which were required to produce one point. The proportion of increase or decrease of this figure for the current month is the measure respectively of the loss or gain of output per man-hour. This is entered in the proper percentage column.

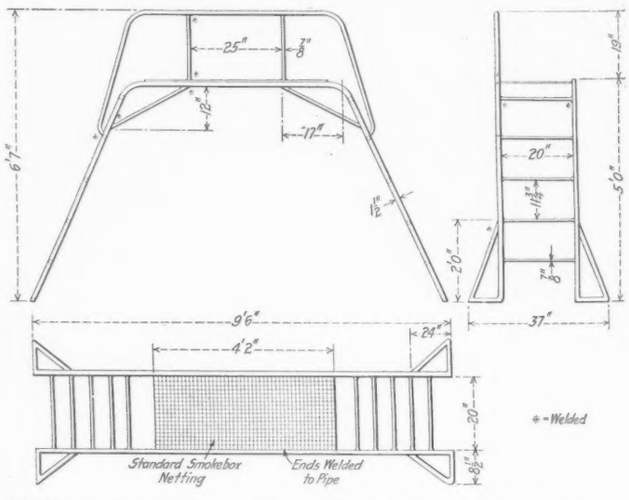
Reference to the drawing will show the method of posting the information. It will be seen that the middle portion of the board is divided into three sections and each section in turn is divided into two parts, one devoted to the current month and the other to the same month of the preceding year. Each part is provided with a column for each week of the month, in which the number of locomotives receiving each main class of repairs which was turned out of the shop during the week is entered in the first section, and the percentage of gain or loss entered in the proper part of the second section. In the third section is shown the number of men employed and the number of working hours per week for the current month and the same month of the preceding year. As shown on the drawing the column captions of this section of the board are lettered on a removable strip of sheet metal which is pulled out of the slide at the end of each month and replaced with one lettered for the next month. In entering the figures in this section, white chalk is used for those for the current month and red chalk for those for the preceding year. The permanent figures in the lower section of the board are painted in the same colors.

The lower section of the board is devoted to a similar record by months, a complete record of the calendar year being entered here month by month.

The scheme is simple to operate and is readily understood by the men. Its value is indicated by the results shown for the first three months of the current year. That the men have taken an interest in the success of the shop is clearly indicated by the marked improvement in output which has been obtained since January and the significant fact in connection with these figures is that the improvement has been effected almost entirely by the men themselves. With the facts as to conditions clearly before them, no other measures have been necessary to bring the output back to and even to exceed that of the same period of the preceding year.

SAFETY PLATFORM FOR THE ERECTING SHOP

The cab of a locomotive, after the engine has been cut off from the tender and placed in the erecting shop, is rather a dangerous place to work and casualties are frequently caused by men stepping off the apron and falling into the pit. In order to remove this element of danger the platform shown in the drawing has been developed and used successfully for some time in the Battle Creek, Mich., shops of the



Platform for Use Back of Locomotive Cabs in the Erecting Shop

Grand Trunk, Western Lines. The frame is built up of pipe and cross pieces of 7/8-in. material, which are welded to the pipe. At the base the frame is 9 ft. 6 in. long and spans the working pit, the height of the platform being 5 ft. above the level of the shop floor. The platform is covered with standard smokebox netting and a pipe rail 19 in. high is placed across one side.

The platform is placed across the pit just back of the locomotive, the front side extending under the back edge of the apron. It thus increases the working space in the cab and provides a safety rail which is an effective protection to the men. The cross pieces between the two frames also facilitate climbing in and out of the cab.

NICKEL PLATE POWER PLANT AT CONNEAUT

Results of a Successful Superheater Installation in the Stationary Boilers at Conneaut, Ohio

BY J. S. MORRIS
Assistant Engineer, N. Y. C. & St. L.

DURING the past few years, the traffic handled by the Nickel Plate has gradually increased, with the result that the shops and engine houses have had to increase their output considerably. This, of course, caused the load on the boiler plants to increase to such an extent that during the winter months the boilers had to work under a heavy overload. The conditions at Conneaut reached a point where it was necessary either to purchase additional boilers or to increase the output of the boilers then in use. At this time it was suggested that superheaters would solve the difficulty.

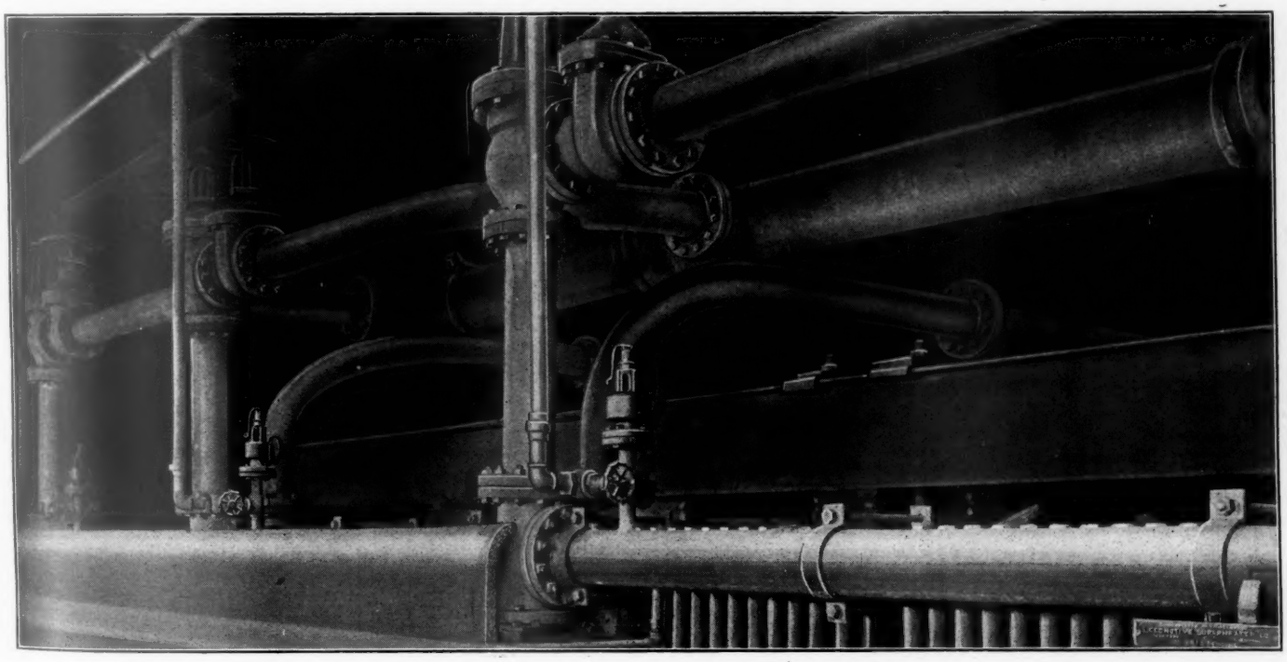
Assuming that the use of superheated steam would increase the capacity of the power plant 15 per cent, the cost of the superheater installation would be approximately two-thirds the cost of installing another horizontal return tubular boiler of a size sufficient to give the same increase in capacity. Not only would the first cost of the superheaters be less but it was thought that they would show an annual fuel saving of at least 10 per cent with the same load, which would not only pay the charges against the investment, but would leave a substantial margin of profit besides. If an additional boiler was installed, the fuel consumption would probably increase, especially at times when the plant was not working under full load.

Description of Power Plant

The boiler house now in use was built in 1913 and contains three 180 H.P. horizontal return tubular boilers, built by the Bass Foundry & Machine Co., and two 70 H.P. Erie City boilers of the same type. All of the boilers are hand fired and use run-of-mine bituminous coal with an average heat value of 12,500 B.t.u. per pound. Each of the three 180 H.P. boilers has 35-inch steel smoke stacks 100 ft. high and the two small boilers have 28-inch stacks the same height.

The engine room, which is located adjacent to the boiler house, contains the following machinery: one 100 H.P. high speed Buckeye engine with piston valves, direct connected to a 75 K.W. direct current General Electric Co. generator which supplies electric power for all of the motor-driven machinery and electric lights for the entire shop; also one 1,050 cubic foot Ingersoll-Rand air compressor with slide valves on the steam cylinders and a 150 H.P. simple Corliss engine which drives all the belt-driven tools in the machine-shop.

The boilers also supply steam for a 75 H.P. Erie City slide valve engine located in the wood mill, about 400 ft. from the boiler house. In the blacksmith shop they have one 1,200-pound steam hammer and one 2,000-pound hammer. A twenty-eight stall engine house located about 600 ft. from the power plant uses steam to blow up engines, and also to operate the engine house. Steam is conveyed to the engine house by means of a four-inch underground steam line. This line is carefully insulated against heat losses and offers several important advantages over the more common type of overhead steam line.

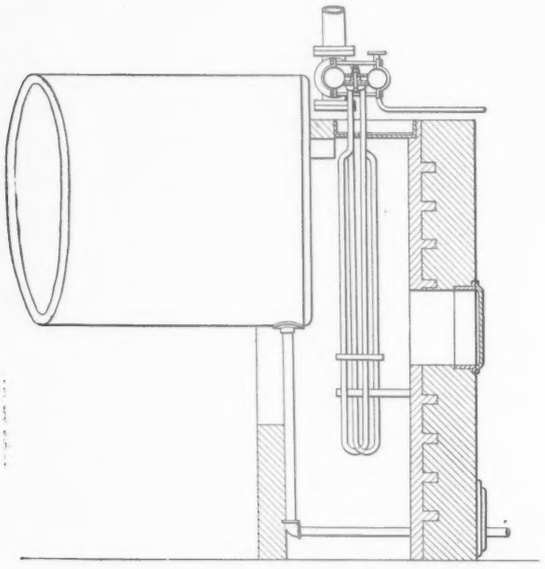


Superheater Header Installed at Conneaut

Description of Superheaters

During the month of September, 1919, superheaters were installed in each of the three 180 H.P. return tubular boilers. The superheaters were designed and installed by the Locomotive Superheater Co. The superheater header is hung horizontally just back of the boiler, with the ends resting on the side walls. The header is constructed of steel and is in two sections; one section for saturated steam and the other for superheated steam. The units, which are made of 1½-inch cold drawn seamless steel tubing, hang vertically from the header in the space between the rear of the boiler and the back wall.

The ball joint on each unit is forged integral with the tube and is clamped to the headers by means of a specially designed forged steel clamp, similar to the arrangement used on locomotive superheaters. The units are arranged in one loop per unit and each boiler has sixteen units with a total of 104 sq. ft. of heating surface.



Superheater Header and Units in Place

Superheaters were not installed in the two 70 H.P. boilers; and in order to separate the superheated and saturated steam, these two boilers were disconnected from the main header and connected directly to the engine house line. A by-pass line was installed between the main header and the engine house line so that the two small boilers need only be used during periods of the year when the three 180 H.P. will not carry the entire load.

Results of Tests

From three to six weeks before the superheaters were installed four complete power plant tests were conducted. Two of these were of eight hours' duration with the power plant carrying the regular shop load from 8 a. m. to 4 p. m. and the other two tests were made at night with the different engines loaded by artificial means. This load was maintained constant for four hours.

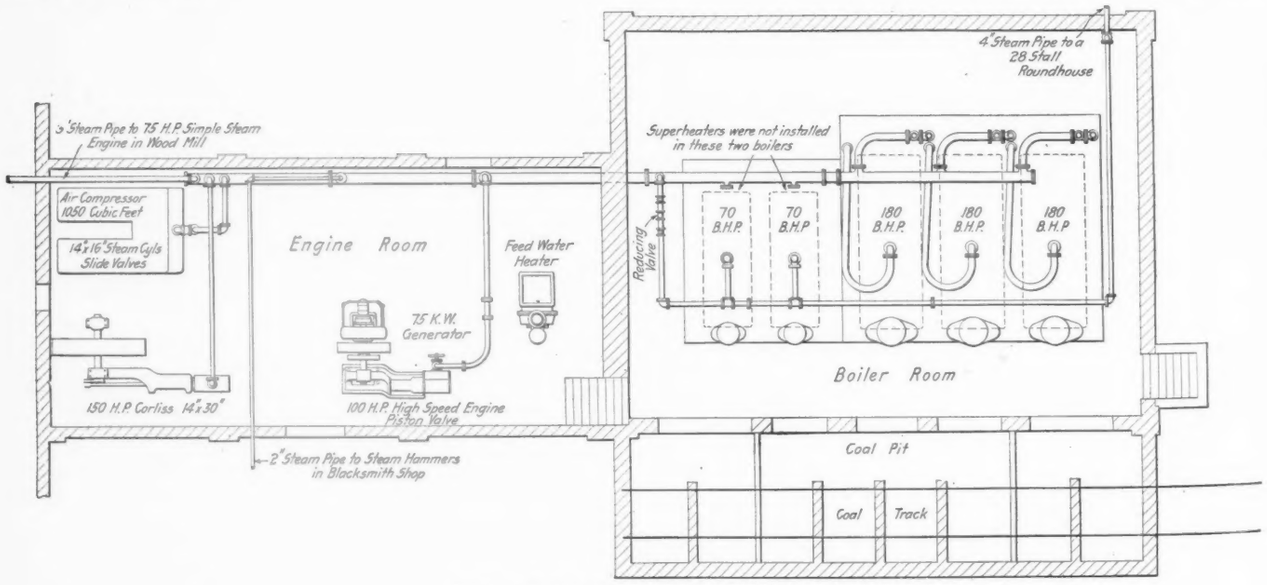
About three weeks after the superheaters were installed, three similar tests were conducted and as far as possible conditions of the original tests were duplicated.

All the coal consumed by each boiler was accurately measured by weighing on platform scales. The feed water was measured by means of a recording water meter which was accurately calibrated before and after each set of tests, and was located between the feed pump and boilers. The average indicated horsepower of the Corliss and wood mill engines was secured by indicator cards taken every five minutes. Switchboard readings were taken at the same intervals. A proximate analysis and heat value of the coal was secured from samples taken during each test.

The two tests shown in Table I were made from 8 a. m. to 4 p. m. with the regular machine shop load on the three 180 H.P. boilers. During these two tests the engine house load was carried on another set of boilers. The two tests shown in Table II were made at night with each engine running under a constant load for four hours, with blacksmith shop and engine house lines cut off.

Table I—Results of Eight-Hour Tests with Boilers Carrying Shop Load Only

	Saturated steam	Superheated steam	Per cent increase	Per cent decrease
Total coal consumed, pounds	17,061	13,469	....	21.1
Steam consumption, pounds	128,100	98,500	....	23.1
Average steam pressure of boilers	115.0	113.6	....	1.2
Average load on Corliss engine, I. H. P.	60.1	59.1	....	1.7
Average load on wood mill engine, I. H. P.	47.9	56.1	17.1	....
Average load on electric generator, kw.	36.8	40.5	9.1	....
Total air compressor revolutions	51,580	47,825	....	7.3
Steam hammer No. 1, minutes in use.	175	249	43.5	....
Steam hammer No. 2, minutes in use.	221	253	14.5	....
Temperature feed water, degrees F.	209	206	....	1.4
Equivalent evaporation at 212 deg. per pound dry coal	7.96	8.47	6.4	....
Efficiency boiler, furnace and grate	58.8	62.4	6.1	....
Heat value 1 lb. dry coal	13,390	13,190	....	1.5
Average boiler horse power developed	487	403	....	17.2
Per cent of rated capacity	90.1	74.6	....	....
Degrees superheat at main header	.....	152	....	....
Degrees superheat at air compressor	.....	127	....	....
Degrees superheat at Corliss engine	.....	103	....	....
Degrees superheat at wood mill engine	.....	14	....	....


4" Steam Pipe to a 28 Stall Roundhouse
3" Steam Pipe to 75 H.P. Simple Steam Engine in Wood Mill
Superheaters were not installed in these two boilers
Air Compressor 1050 Cubic Feet
14½-16" Steam Cyls Slide Valves
Engine Room
Feed Water Heater
75 K.W. Generator
70 B.H.P.
70 B.H.P.
180 B.H.P.
180 B.H.P.
180 B.H.P.
Reducing Valve
Boiler Room
150 H.P. Corliss 14½-30"
100 H.P. High Speed Engine Piston Valve
2" Steam Pipe to Steam Hammers in Blacksmith Shop
Coal Pit
Coal Track

Outline of the Power Plant at Conneaut

Practical Results Obtained

The following table shows the number of tons of coal consumed by this plant during the past three winters, with satu-

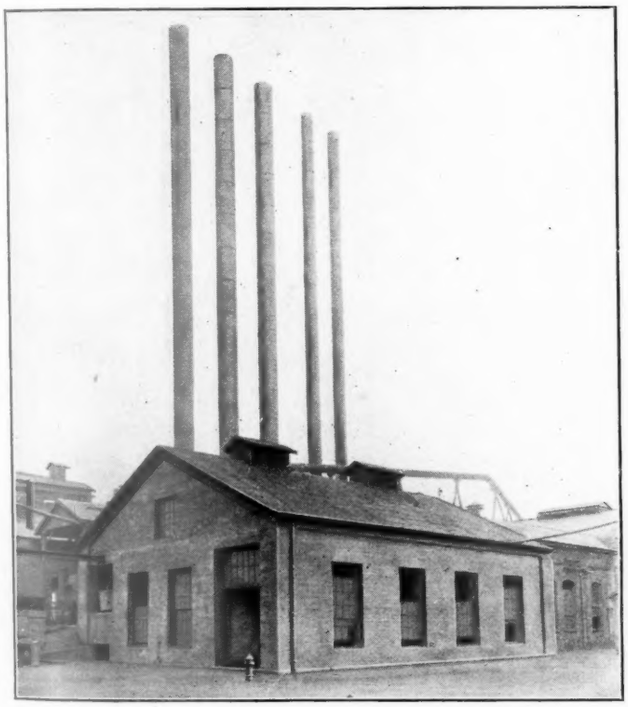
rated steam used during 1917-18 and 1918-19 and superheated steam during 1919-20:

TONS OF COAL CONSUMED PER MONTH

	1917-18	1918-19	1919-20
October	838	1,087	797
November	952	885	877
December	1,314	1,174	1,080
January	1,371	1,174	1,340
February	1,125	1,062	1,116
March	1,311	1,105	1,066
Total	6,911	6,487	6,276

It is apparent that a very material saving in fuel has been effected by the superheaters. A comparison of the past winter with the winter of 1918 and 1919 is not entirely fair as the past winter was very severe and long and the fuel obtainable was of poor and very irregular quality, while the winter of 1918-19 was mild throughout and the fuel obtainable was the best. Even under these conditions the superheaters show a considerable reduction in the amount of coal consumed.

A comparison with the winter of 1917 and 1918 is more nearly fair, as the weather and fuel conditions were about



The Boiler House at Conneaut

the same as during the past winter, and in this case the superheaters show a very marked reduction in the amount of coal consumed.

Fuel economy is not the only benefit that has been obtained from the installation of these superheaters. A very important result has been the improved operation and output of the different steam engines, steam hammers, air compressors and blower lines. No figures are available showing the actual savings due to this cause, but experience has demonstrated that the improvement has been considerable. Especially was this noticeable in the wood mill engine, which is located about 400 feet from the boilers. Before the use of superheated steam, this engine was badly handicapped during the winter months, due to the large amount of condensation in the three-inch overhead steam line, with the result that it was unable to keep the wood mill machinery operating up to the speed at all times. Since the superheaters were installed this trouble has been entirely eliminated and the engine has sufficient power to easily handle the wood mill load.

The same condition existed but to a less extent in connection with the engines and in the main power plant, as there has been a decrease in the condensation and friction losses in the four-inch underground steam line. From several tests it was found that the pressure available at the engine house was from five to ten pounds higher with superheated steam than with saturated.

At the time the superheaters were installed there was some question whether the slide valves on the air compressor would operate successfully with superheated steam. About two months after the installation the valve chest covers were removed and it was found that the valve seats were in good condition and have caused no trouble since. Except for the installation of additional valves, together with the changes in connections incidental to the superheaters, the power house steam lines have not required any rebuilding and are giving satisfactory service. Shortly after the installation, two or three of the old flange gaskets in the main header blew out and had to be replaced. On one or two occasions it has been necessary to tighten up the units, which proved a simple matter, as all these bolts are accessible from outside the boiler setting.

TABLE II—RESULTS OF CONSTANT LOAD TEST MADE AT NIGHT

	Saturated steam	Superheated steam	Per cent increase	Per cent decrease
Total coal consumed, pounds	9,316	6,827	....	26.7
Steam consumption, pounds	57,500	46,000	....	20.0
Average steam pressure of boilers	118	115	....	2.5
Average load on Corliss engine, I. H. P.	43.0	43.6	1.4	....
Average load on wood shop engine, D. H. P.	43.2	42.8	....	0.9
Average load on electric generator, kw.	56.7	56.8	0.2	....
Total air compressor revolutions	26,590	26,630	0.1	....
Temperature feed water, degrees F.	212	207	....	2.4
Equivalent evaporation at 212 deg. per pound dry coal	6.63	7.82	17.9	....
Efficiency boiler, furnace and grate	47.6	57.7	21.2	....
Heat value 1 lb. dry coal	13,510	13,190	....	2.4
Average boiler horse power developed	386	336	....	12.9
Per cent of rated capacity	107.0	93.3	....	....
Degrees superheat at main header	.....	163	....	....
Degrees superheat at air compressor	.....	143	....	....
Degrees superheat at Corliss engine	.....	119	....	....
Degrees superheat at wood mill engine	.....	9	....	....

BURNING EASTERN COALS ON CONVEYOR FEED TYPE STOKER.—Difficulty has been experienced in burning eastern bituminous coals on chain grate stokers, due to the fact that they cake under the arch, preventing the entrance of air through the fuel bed and checking combustion. In a paper presented before the American Society of Mechanical Engineers, Lloyd R. Stowe described a stoker developed by the Laclede-Christie Clay Products Company, which it is claimed may be used satisfactorily with eastern bituminous fuels. The stoker is of the conveyor feed type and operates with mechanical draft. High ignition temperatures are employed. The air supply is graduated from the feeding end to the discharge end and the fire is thickened at the point of ash discharge. These features are said to result in the prevention of caking, the assurance of a CO_2 content of from 10 to 12 per cent and intimate mixture of air with the combustible gas. Rates of burning up to 60 lb. per square foot of grate area per hour are obtained as compared with 25 to 35 lb. on chain grates. The percentage of combustible in the ash is reduced 50 per cent.

GOVERNMENT OPERATION has left the country with an insufficient number of cars and locomotives, and with an unusual proportion of the existing equipment out of order. There is to be a shortage of cars for a long time to come. It is well to know where responsibility for it chiefly lies. But the really important thing just now is to look ahead and make arrangements for the most efficient use of such cars as the country has in working order.—*Boston Transcript.*

Looking Down the Erecting Bay in Silvis Shop

REDUCING THE COST OF LOCOMOTIVE REPAIRS*

Use Modern Tools and Scheduling System; Keep Men at Their Jobs; Avoid Unnecessary Finish

BY S. W. MULLINIX

Superintendent Shops, C. R. I. & P., Silvis, Ill.

REDUCING the cost of repairing and maintaining locomotives has been open for discussion ever since railroads have been in existence and is one of the most important questions which confronts the mechanical department today; one which can only be solved by careful study and efficient handling, plus good, hard, honest labor.

In order to be brief, and to cover the subject as thoroughly as possible, I will divide the cost between labor and material, treating each one separately.

Labor

Never before has labor in all its branches required the efficient handling that it does today, and in view of the enormous increase in the cost of labor, we must find methods of increasing the production of every employee.

Make use of all existing labor saving devices, such as electric and oxy-acetylene welders, high speed tools, drills and cutters, air tools, electric trucks, cranes and hoists. Create wherever possible new labor saving devices, or better methods of doing the work. Purchase where possible modern machines to replace obsolete machines found in a great many railroad shops today. While a great many modern machines and tools have been installed, we have not kept pace with other manufacturing industries in the purchase of tools and machinery to handle repairs to the present locomotives. Establish and maintain rigid standards on as many parts as possible that they may be manufactured in quantities on machines especially adapted for the purpose. This alone will save many dollars in labor in small shops and roundhouses that are forced to furnish parts they have not the facilities to make, which might just as well have been manufactured in larger shops, or better still, in a separate manufacturing plant.

Rearranging and Regrouping Machines

The rearranging and regrouping of machines to eliminate the handling of material from one part of the shop to another often produces great savings. I recall one case where machines were rearranged for repairing driving boxes. From the time the driving box was placed on the floor to be overhauled complete with crown brass turned, shaped and pressed into box, gibs and lateral face applied, drilled, plugged and planed, the cellar fitted and the box bored ready to apply on the journal, it traveled just seventy-two feet, and part of this distance was from one hoist to another.

In another case on the repairing of flues, from the time the flue was started on the first machine, after it had been rattled until it was completed, safe end applied, cut to length, tested and annealed, it traveled just sixty feet, with no back hauls whatever.

Dividing Shops Into Separate Departments

When large enough, divide shops into small departments, such as rod and link, wheel, air, etc., giving each, machine and equipment enough to perform its own work without depending on some other department. Have some one responsible for the performance of each department.

Cleaning and Stripping Engines

Engines and tanks should be thoroughly cleaned, all coal and cinders removed, and the boiler washed out before the engine is placed in the shop. Cleaning vats should be located as near as possible to the place where engines are being stripped and parts should be cleaned before being sent to the various parts of the shop to be repaired. All parts removed should be stenciled or tagged with the engine number so they may be replaced on the engines they were removed from. Many small pieces find their way to the scrap dock because they are not properly marked.

Do no more stripping than is absolutely necessary. We should be as careful in stripping an engine as we are in assembling it, for every piece removed must be replaced. We sometimes take down parts that were renewed or put in 100 per cent condition in some roundhouse only a few days before the engine was sent to the shop. Sometimes, in

*Paper presented at the Western Railway Club, on April 19.

order to get a few more miles out of the engine, after general repairs are authorized, steam pipe joints are ground and pipes reset. Piston or valves may have been renewed. In the event of any parts of the locomotive being in 100 per cent condition, the division people should so notify the shop. Care and good judgment should be exercised in stripping locomotives that come in for general repairs. A sledge and chisel bar in the hands of some one who does not know just what to remove, and how to remove it, can destroy in a few minutes that which will take much time and money to replace.

Engines should be carefully inspected before being placed in the shop, and also while being stripped, and parts such as pedestal binders, where found loose on the frame fit, should be marked the amount necessary to close before being removed, and should be repaired before being sent back to the engine.

Testing and Annealing Parts Removed

Parts removed, such as piston rods, valve stems, motion work, brake and spring rigging, crank pins and axles, and main and side rods after being cleaned should be carefully examined for cracks and flaws. Where possible they should be painted with a thin coat of good white-wash; this also applies to frames. After this has dried for some time, if there are any cracks or small checks, the oil or grease will work through the white-wash and can plainly be seen. It is also good policy to anneal as many of these parts as possible as undetected flaws will show up while the pieces are hot.

Work Reports

An engine sent in from outside points should be accompanied by work reports, made out by the person having direct charge of the engine, as he knows the good and bad points of the engine under his charge, and is more competent to make out an intelligent report that will be of some use to the shop. The practice in many places of filling out the form furnished by the office, is to mark after each item "Repair" or "Examine," being sure to name all parts of the engine, so that if any defects are found after the engine has been repaired they can place responsibility on the shop making the repairs by referring to their work report.

Too much care cannot be taken in making out an accurate work report. All defective parts which have been giving trouble should be so reported, parts which have recently been repaired and are in good condition, such as air pump, crossheads, piston and valves, lubricators, injectors, and reversing gears, should be so reported, which will save the time and labor of removing and examining them.

Locomotives scheduled for the shop should be examined as far in advance of shopping as possible, to determine repair part requirements so that the store department will have plenty of time to meet the demand by placing orders for castings and other material not on hand. This examination should be supplemented by a more minute check while the locomotive is being stripped, at which time parts are more accessible. Care should be exercised to prevent the diverting to other uses of material intended for locomotives in the shop.

Every effort should be exercised to abolish the so-called "robbing system," a process used in reality as a substitute for material short in the store. Main shops of many railroads are called upon to furnish new and second hand material for shipment to outside points for ordinary as well as emergency use. Outside points are guilty of ordering such repair parts for emergency use in order to insure delivery when in reality there is plenty of time to manufacture and deliver. The removal of parts for such purpose from locomotives awaiting shop is expensive. Very frequently such parts as side and main rods, guides and cylinder heads that have been carefully refitted to the locomotives in the shop are removed and shipped.

Keeping Men at Their Work

Tool room and portable tools should be located in convenient places with respect to points where work is being performed to avoid unnecessary errands of mechanics and helpers.

Each employee should be given his assignment of work and to make it possible for him to perform it in a reasonable length of time, he should be given a fit place to work, proper tools to work with, supplied with working material, and, if necessary, instructed tow to do it. This eliminates the need of men going from one department to another to get material and information. I recall one case which happened some time ago; the man operating the machine planing crossheads for guide fit, after getting the crosshead on the machine, would start out to find the size of the guide. Going first to the engine in the erecting shop, and not finding the guides, he would come back to the guide planer. If guides were not planed he and the man operating the machine would determine what size the guides would true up at, so he could go ahead and plane the crosshead to suit. This can be eliminated by having the foreman examine the guides while the engine is being stripped, and determine just what is needed and filling out a form made especially for the purpose, in two copies, which shows guides to be planed, the size to plane them to, or whether they are O. K. also giving the size. These forms should be sent to the guide and crosshead planer. In this way when the planer operator is ready to plane the crossheads, say for engine 2500, he takes the slip for this engine which shows right top guide planed to 7⅝ in. or the right top guide O. K. 7⅝ in, and so on for the other three guides, then planning the crosshead 1/32 in. wider for clearance. This eliminated the necessity of either operator leaving his machine. It also enables the crosshead man to repair and plane the crossheads and deliver them to the erecting shop in many cases before the guides are planed.

The same applies to laying out shoes and wedges for driving box face. In most cases the men doing this work wait until the driving boxes are planed, making several trips back and forth to see when they will be finished. Most shoes and wedges are laid out to a 1-in. gauge. A good procedure for this work is as follows: As soon as the engine is blocked and binders refitted, shoes and wedges are put up and laid out, taking the size of the box from blue prints which we will call 14 in. Shoes and wedges are laid out for a 14-in. box, allowing for a 1-in. gauge and sent to the machine shop to be planed. Work on the spring rigging can then proceed and the engine be made ready to wheel when the foreman in charge of driving boxes has them finished. He calipers each of the boxes which are planed in pairs where possible. In all cases boxes should be bored central with shoe and wedge faces.

If the box, which according to the blue print should measure 14 in., calipers only 13½ in., he makes out a slip, showing the right and left shoe and wedge to be planed to a 1¼ in. gauge, giving the slip to the men operating the shoe and wedge shapers. In cases where there is not enough stock to true up the size given they are planed 1/16 in., ⅛ in., or 3/16 in. and liners applied to the inside. This should be done before shoes and wedges are sent back to the erecting shop. If possible a small drill press and bench should be located close to the shoe and wedge shapers.

On piston valve engines the gang foreman should examine the bushings and if out of round or worn hollow, he should fill out a form to be sent to the valve bench, which shows the engine number, whether the bushings are O. K. and giving the size, or whether they are to be bored and to what size they will bore out. A good practice is to bore valve bushings only twice, ⅛ in. or ¼ in. over the original diameter. All rings and bull rings can be fitted to a bushing made for this purpose, and only in rare cases is it necessary

for men on the valve bench to go to the engine to fit rings. It also enables them to fit up their valves before the bushings have been renewed or rebored and makes it unnecessary for one department to wait on another.

The use of portable machines in the erecting shop for fitting frame and guide bolts, and for special pins and studs will save many trips from the machine to the erecting shop.

Roundhouses of any size should be equipped with enough machinery to handle their own work, especially their small work, as many hours of costly labor are consumed by mechanics and helpers going back and forth from the roundhouse to the back shop to get some small job done, which in itself interferes with the routine work in the back shop.

Routing and Scheduling

In all shops larger than the so-called one-man shop, there should be some method of routing engines and work through the shop, or a schedule system which will enable all departments to know just what work is to be finished first and when it is expected. Such a system enables the man in charge to tell just what departments are holding back the output. In nearly all shops the output is controlled by one department, and any steps that will tend to build up this weak department will increase the output. It is very essential that our forces be equalized.

No matter what the system, whether it be simple or elaborate, it will be of no use unless it is followed up and followed up religiously.

Supervisory Forces

One of the most important factors in increasing the efficiency of shops and roundhouses is the supervisory force. It is up to these men to make a careful study of their own particular class of work and department. They should be thoroughly familiar with locomotives and the tasks they have to perform and the conditions under which they have to perform them.

I believe a gang or boiler shop foreman should have some roundhouse experience, as only by actual experience do we realize what the roundhouse people have to contend with, and to know the things which give the most trouble. A machine-shop foreman should have some erecting shop experience; he should also be familiar with the so-called standard practice cards used in a great many shops to describe the manner of doing different classes of work. These foremen should be examined from time to time to make sure that they are familiar with all standard practices.

The staff meetings held once a month or oftener if possible, are very good if conducted with the spirit of making all feel that they are officers of the company and bringing them to realize the importance of doing their duties as such. We must increase our production without increasing the physical exertions on the part of the employees. I recall one instance which will give a good illustration. We used to saw cylinder packing rings by hand, which for two cuts required at least 15 minutes of hard labor. The rings are now cut in a special machine requiring only one blow with a light sledge and about two minutes' time.

The supervisory forces in large shops today are often compelled to use their judgment in doing certain pieces of work against that of the district or division mechanical people. An engine may have a cracked cylinder. The district or division people will in most cases recommend a new cylinder. The shop people after an examination may decide to weld it. In some cases we are unsuccessful, which results in our having to apply new ones, but there are many cases where the welded cylinders have given just as good service and have saved the company many dollars in labor and material. This applies to many other items besides cylinders.

The handling of men today to get the best results is a far greater task than it was years ago. What will work in one case will not apply in another. It may be necessary to drive one man, beg the next and pray to another, but the course that will bring results is the one to use, and use continuously and eternally.

Suggestions from the Men

Many good suggestions will come from the rank and file if they are solicited in the proper spirit. Where we find a man trying to better conditions we should encourage him. It is not in our power to compensate him beyond his regular wage, but it is our duty to give him credit for the good things he does. It is surprising what good can be accomplished by patting a man on the back once in a while. In order to be efficient, men must be contented. This was shown very clearly during the period when the wage question was being settled.

If men are to be contented they must have good surroundings. The first impression a man has when he starts to work in a new place in all probability is a lasting one. If he is given a dirty locker, a broken monkey wrench and other tools not fit to work with, the chances are that, although he is a good man, he will be dissatisfied and will not remain with us. Men should have clean lockers and lavatories. If given good tools and a good drawer or box with a lock to keep them in, you will find that they will take care of them.

A man should be given his task to perform and if he is contented he will perform it.

Any job that is worth doing is worth doing right, and do not put off until tomorrow the things that should be done today, especially in a roundhouse. Although these things are as old as the hills, they are far more important today in reducing the cost on our locomotives than they were when they were written.

Visiting Other Shops

A great deal is accomplished by going to other shops to make observations and study the progressive features, whether they be large or small. We often run across kinks that are good and productive of reducing costs. A few years ago I had occasion to visit a large locomotive shop and noticed the operator anchoring a cylinder bushing preparatory to boring it out by means of two 5/8-in. chains, each with a clevis on one end and an eye bolt on the other. The clevis was made fast to the bracket of the bed plate, the chain then thrown over the bushing and the eye bolt put through the bed plate, with the nut on the under side, thus taking the place of clamps, blocks and bolts. Besides, the job is done in less than half the time and is more secure. I lost no time when I returned to my home shop to tell the operator of the arrangement. He at once ordered the chains, and now you could not get him to part with them.

We send foremen occasionally to other shops and they never return without bringing something that is an improvement over what we have. My experience has been when visiting shops that the officers in charge have always been glad to impart any information asked for, and also seem to take pride in showing their practice. If we feel that our methods are better than theirs we should say so.

We often get many good kinks from the supply men, as they have the advantage of seeing how work is being done in a great many shops, especially those who had been connected with the mechanical department.

Material

Material represents approximately 40 per cent of the cost of repairing and maintaining locomotives, a large part of which is purchased either rough or finished. Owing to the high cost of labor and the absence of modern and special production machines in many railroad shops, there are many articles which can be purchased finished cheaper than they can be manufactured on our railroads. There are also many articles sent from the purchasing to the mechanical department to be tested to see how they compare with home-made

articles, as well as to compare them with similar articles from other manufacturers. These tests should be given careful consideration, as they very often decide a standard for an entire system. Sometimes what is considered a successful article or tool in one shop is complained of by another. For that reason when an article is being tested it should be gone into thoroughly and passed on by competent employees.

Have any of us ever stopped to figure in dollars and cents the amount of labor which has been wasted on materials, such as hard castings, requiring twice as long to finish as it should? How often do we find, after spending many hours of labor on some piece of material, that it is full of blow holes or cracked? It has no doubt been passed on by the test department, but no matter how thorough they are they will not find all of the defects, especially in rough material. It is up to us to examine very carefully and to use good judgment in passing on material which is to be finished. True, the people we purchase the material from will replace the rough material, but they do not pay for transporting it back and forth to the store department, and from there the handling to the shop and back, or the amount spent for labor in the shop.

The mechanical department should work very closely with the store department on unsatisfactory material, calling their attention promptly to any article that is not standing up or giving the service that should be expected, so they can get in touch with the manufacturers for correction.

During the war period the locomotive costs have also been greatly affected, due to shortage of material, making it necessary to substitute all classes of material.

The mechanical department is to blame to some extent for this condition, due to the changing of patterns and specifications. These changes, no doubt, are paying propositions, but they tend to discourage the store department from carrying any large amount of stock. The mechanical department is also responsible for the great number of parts which the store is compelled to carry in order to supply the different styles and types of equipment, such as air brakes, injectors, safety valves and lubricator parts. Would it not be far cheaper to scrap the obsolete equipment, replacing it with standard material that will give better results and reduce the number of repair parts to be carried in stock?

We must check over our material and equipment, eliminating where possible, and we must bear this in mind at all times, not go over them once and then sit back and imagine that the job has been completed. It never will be as long as we operate railroads.

Another very expensive practice is the robbing of material from one engine for another. We not only pay for removing and replacing the part removed, but the chances are that it will cost more to apply the piece removed than it would to apply a new one. If each one of these items were traced down it will be found that if some one, whoever he may be, had been on the job it would not have been necessary. What per cent of the material we use does not give us the expected service because of other conditions? For instance, we will pack a piston rod half a dozen times, never getting it tight on account of an imperfect rod or the guides not geing properly lined. If we had found out where the trouble was in the first place and corrected it we might have saved five sets of packing and the cost of applying them. This applies to many items used on our locomotives.

Material where carried in stock by the store should not be ordered before it is to be applied, especially small finished parts, as they will be thrown around and either broken or lost, necessitating ordering another piece which will double the cost. Shop people should be familiar with the cost of the different items of material they use. It is surprising to many good railroad men when they learn just what many small items really do cost, and probably they would think twice before saying, "Oh, throw it away and put on a new one."

An item of material where the quality has a great deal to do with the cost is the paint for locomotives. No matter how carefully or how scientifically it is applied, poor paint will not give good results and will have to be renewed much oftener than a coat of good paint. We are not painting our locomotives, especially our freight engines, merely to beautify them, but to preserve the material. An old coat of good paint is much better than a new coat of poor paint.

We should be far more efficient in the handling of material than labor, as the human element is not a factor to any great extent. If we watched more carefully the things we scrap there would not be so much material to reclaim. The more lax we are in scrapping material the better showing the reclaiming plant can make.

Manufacturing Locomotive Parts

The use of forging machines in our blacksmith shop certainly has worked wonders in producing forgings requiring very little or no finish, such as small side rods, eccentric rods, motion work, spring hangers and yokes, large hex nuts and other like material. I believe the blacksmiths take a great deal more pride today in doing their work so as to eliminate finish. For example, in main and side rods, the center sections are forged to size, requiring no finish except where the rods are channeled. Guide blocks should also be forged requiring no finish except where they fit on the cylinder head and one face for the guides and yoke. Guides also should be forged so as to eliminate as much finish as possible. Parts such as piston rods and valve stems should be cut to the proper length. Wedge bolts should be forged and the ends squared, so all that is necessary to complete them is to thread them in a bolt cutter. These were formerly made from bar stock on turret machines. Eccentric blade forks and ends and jaws for other motion work should be made allowing finish only where they fit on the links. Outside contours may be ground off. Eccentric blades for outside valve gears should be forged, allowing finish only on the sides, on the back end and for link fit on the front end. Large hex nuts and castle nuts should be forged and the holes punched, allowing very little finish. There are many other items where finishing can be reduced or eliminated if we only look for them, as the less number of operations necessary to produce a finished part the less the cost will be. Dies for this work are very expensive and should be taken care of, but they will pay for themselves many times over.

Castings

Patterns should be changed to reduce or eliminate finish where possible and changed from brass to cast iron or steel, or from cast iron to steel where parts are apt to break. If it is absolutely necessary to use brass, use it; if not, use either cast iron or steel. We are using many castings in the rough today which a few years ago we thought necessary to finish all over, such as side rod collars, wedge blocks and collars for main rods and strap middle connections, as well as many other small castings. On parts such as cast iron piston heads, allow finish only on the outside for cylinder size and the inside for the rod fit. Cast front cylinder and valve chamber heads with finish for the joint only. Core as many holes as possible and cast oil grooves in driving box brasses to save the time required to chip them. Core slots in driving box wedges for wedge bolts to size and maintain one standard for all wedges. All grate, side and center bars and supports, ash pan and grate shaker rigging castings, castings for tanks and front ends, cylinder cock and whistle rigging castings should be cast ready to apply on engines, with all holes cored and all castings the proper size and shape. The use of metal patterns is a help in securing good castings of the proper size and shape, as they will not warp or twist out of shape. Eliminate as much as possible finish on whistles, cab fixtures, blow-off cocks, boiler checks, cylinder cocks and valves, bells and yokes, relief valves, parts for piston and valve stem

packing, oil cups, swab holders, grease cups and plugs. Many of these items are used in large quantities and every little saving you can make will help to reduce our cost.

Where it is necessary to finish castings or forgings, be sure to allow enough finish, as it is much cheaper to remove ⅛ in. than merely to scrape off the sand or scale.

Reclaiming Material

We have made wonderful progress in the last few years in reclaiming material. Although it will not be so noticeable in the next few years, the results will be as good if not better, as we are making a more careful study of the things which might be reclaimed and other places where we can use material which has been reclaimed. We are also making many special machines, such as rattlers for cleaning nuts and other small material, cutting shears and machines for straightening iron, special tools for cutting gaskets and washers from old leather and rubber. The electric and acetylene welders have also worked wonders in reclamation. Most of this material is reclaimed after reaching the scrap dock and is handled in most cases by a special reclamation department. There is another side to reclamation which is not so often heard of. This is the reclaiming of broken parts on locomotives without removing them or by removing, reclaiming and replacing on the same engine they were removed from. In most cases this is done either with the electric or acetylene welders.

There is very often a close margin between the cost of reclaiming a piece and purchasing and applying a new one. In these cases we should apply the new piece, as too often in figuring the amount which we save we try to make the figures look as attractive as possible without taking into consideration the life or wearing qualities of the reclaimed piece as compared with a new one. We must guard against letting our enthusiasm get the best of our good judgment. I venture to say that there are many parts being reclaimed today at a loss in dollars and cents in the long run; it is the cost per mile that tells the tale—both in material and labor. Other cases will actually show a great saving. One which recently came to my attention was a 10-wheel engine with a main wheel loose on the axle. The wheels were removed and the loose wheel pressed off. The wheel fit, which was 8½ in. in diameter, was built up with the electric welder and turned off to 8⅝ in., the wheel bored to fit and the old key way used in remounting. Boxes and eccentric straps were replaced, the wheels put up and the engine was ready for service in a very short time, saving not only a new axle but many hours of labor.

Where parts such as piston rods, valve stems and other like material have been reclaimed by building up for fits, they should be properly annealed before being turned to fit. Where rods or stems are worn close to the scrapping limit, or to the age limit if we have one, it is not advisable to reclaim them.

The practice of welding small broken cast iron parts which in the first place do not require much finish is not worth the chances you take of not getting a good weld. In many cases a new part will be just as cheap and much better.

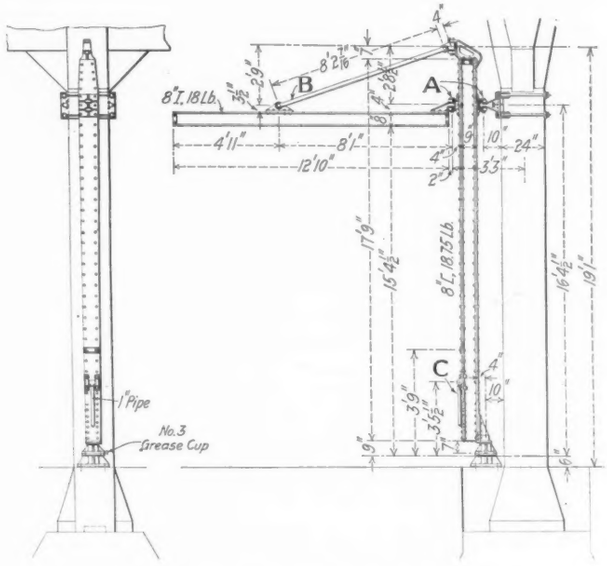
As I look back through the years that I have been employed by various railroads I can plainly note the progress year by year, made possible both by more modern machines and tools and by improving our methods of doing work. Still our progress has not kept pace with the development of locomotives, which are now not only much larger but are equipped with modern appliances such as mechanical stokers, superheaters, feed water heaters, brick arches and power-reverse gears, all adding to the cost of maintenance. There is no comparison between the cost of repairing engines today and a few years ago. The average cost has increased year by year, but let us hope that by our united efforts we may make it possible by more efficient methods to stop the upward trend of this cost, as this is necessary before we can reduce it.

JIB CRANE FOR ENGINEHOUSE COLUMNS

BY NORMAN McLEOD

The problem of designing an efficient form of crane for facilitating the work around the front end of locomotives in engine houses has attracted the attention of motive power engineers for some time. It is believed that the defects in cranes of this class previously designed and illustrated in the *Railway Mechanical Engineer* have been largely overcome in a 4,000-lb. capacity jib crane which has recently been designed and is shown in the sketch.

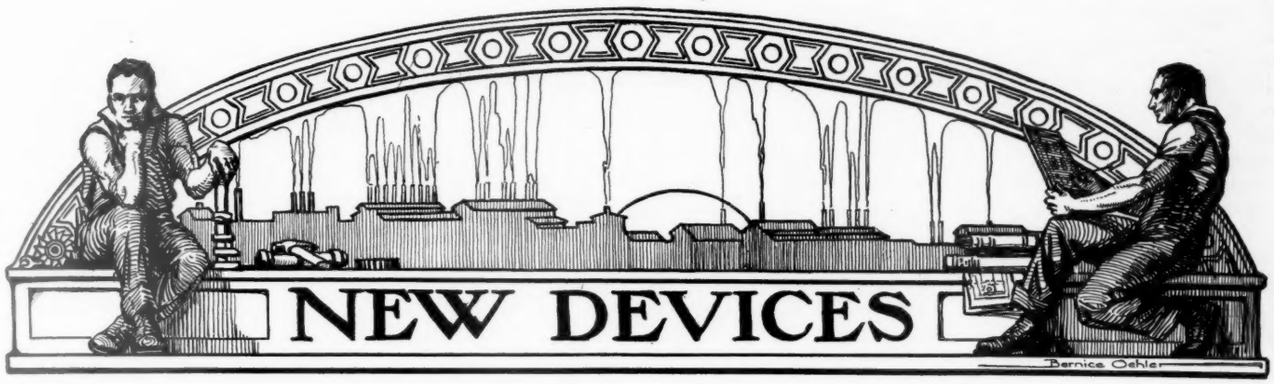
This crane is so designed that by the employment of a compound or toggle joint as shown at *A*, the jib is allowed to travel the full circle of 360 deg., which gives this crane an obvious advantage over cranes having a lesser radius. Sudden shock and strains on the column are greatly reduced by



Jib Crane With Toggle Joint Support

having the bottom trunnion and its supporting bearing entirely free from the column and supported on a concrete foundation independent of the column. The location and fastening of the tie bars *B* allow the maximum travel of the hoist, which runs on the lower flanges of the 8-in. I-beam. When supported by a wooden post, the elasticity of the wooden column cannot cause this crane to get out of alinement to the extent of causing the bearings to bind as may happen with the usual type of jib crane. Provision is made for turning the crane in the swinging 1-in. wrought iron pipe hinged at *C*. The entire crane is made of structural steel with special castings as is shown in the drawing and requires no further description.

Sixty-Year-Old Powder Car.—The Nashville, Chattanooga & St. Louis which operates through a section of the country that figured prominently in Civil war annals has in service a car which is stated to have been used during the Civil war. It is a box car and was used for the transportation of explosives by the Union armies in their operations around Chattanooga and Atlanta and appears to have had an adventurous career. As an active agent in the war its work was brought to an end when it was dumped into the Etowah river by the Confederate general, Hood. It was, however, fished up and in due course was adapted as an express and baggage car. It has been in more or less continuous service and recently has been used on construction.



Refrigerator Car Gas Eliminating System

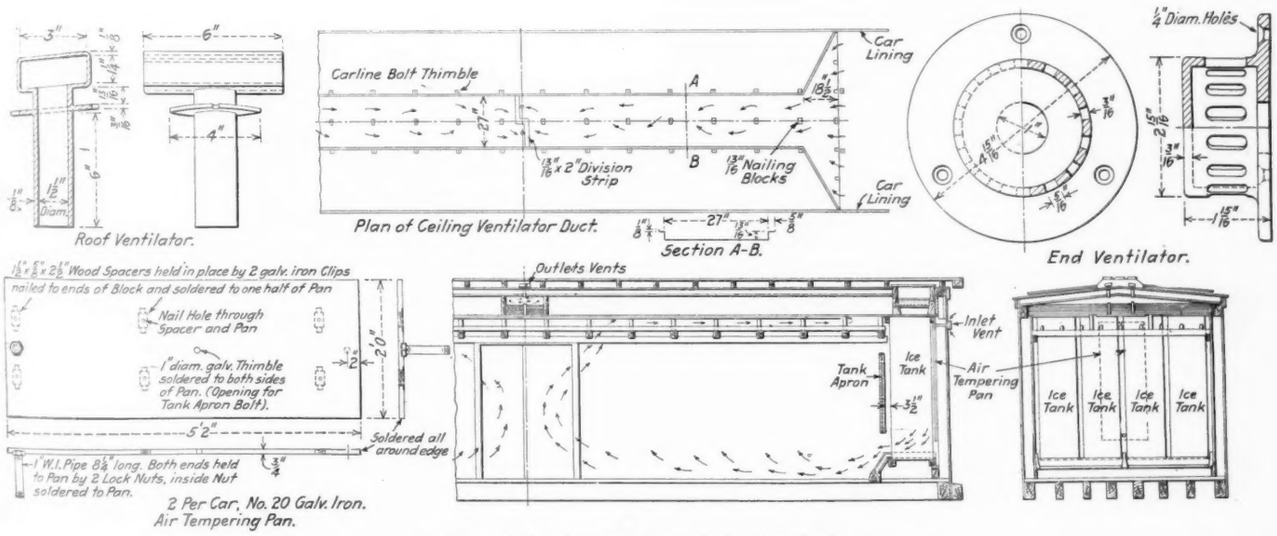
A SYSTEM for facilitating proper refrigeration of meat, vegetables or other substances subject to decomposition under ordinary atmospheric conditions, which is applicable alike to large or small ice boxes as well as to refrigerator cars, has been developed and is now controlled by the Acme Refrigerator Corporation, Chicago. This system, known as the Clinton Refrigerating and Eliminating System, is not in the ordinary sense of the term a refrigerating system. Its function is to remove from the atmosphere of the refrigerator the gases produced by bacterial action in the breaking down of the tissues of the product under refrigeration, and it is designed for use with any cooling system.

In all living animals there are myriads of active bacteria both toxic and anti-toxic. As soon as life is extinct, however, all anti-toxic activity ceases while that of the toxic bacteria continues. Immediate chilling to a temperature below 40 deg. F. causes the activity of all acid producing bacteria to be suspended, with the result that the meat becomes coated with a firm serum film which will protect the product against the action of air-borne bacteria, provided the atmosphere surrounding the product is kept free from excessive moisture.

The action of bacteria on the product produces both heat and gas, the heat being removed by the circulation of the air over the cooling medium. The so-called tissue gas and other gaseous by-products resulting from bacterial activity, however, readily absorb moisture which is deposited against the cool surfaces of the product and the sides of the car. As a result of such condensation the car sweats and becomes moldy, and the moisture deposited on the surface of the product dissolves the serum film and increases the moisture content above the point at which the activity of all harmful bacteria is suspended. In the case of meats, the result is a slimy surface and an increased bacterial activity which breaks down and liquefies the solid protein material with the production of the acids CH_3SH and H_2S, both of which have disagreeable odors. Essentially the action is the same in the case of vegetable products.

The design of the Clinton Eliminating System is based on the principle that it is necessary to remove from the car the bacterial produced gases without lessening the efficiency of the refrigeration and circulation of the atmosphere within the car. The removal of these gases with their high moisture content produces a dry, clean atmosphere, the condition least favorable for bacterial activity and hence most favorable for the preservation of perishable products.

The gases produced by bacterial action, due to their difference in density as compared with the air, tend to stratify in the upper part of the car close to the ceiling, and the eliminating system makes use of this difference in density as the propelling force to remove these gases and replace



Details of the Clinton Gas Eliminating System

them with air from outside the car. The gases are collected in a shallow duct 13/16 in. deep, located just below the ceiling and open for the full width of the car near its ends. The duct is divided into two parts near the longitudinal centerline of the car, from each of which an outlet vent is led through the roof, the tops of the vents being located under the running board. These vents have an inside diameter of 1½ in. and their continuity is broken in a chamber between the ceiling insulation and the roof of the car.

In order to effect the elimination of the gases collecting in this duct, provision must be made for drawing in an equivalent amount of fresh air. This is done through inlet vents in the ends of the car opening into thin air-tempering pans which are placed in the space between the end lining and the ice tanks. In the drawing these are shown to be 5 ft. 2 in. long by 2 ft. wide, and are only ¾ in. deep. The vents through the ends of the car open into the pans near the top and the pre-cooled air is admitted to the car through openings just above the bottom on the sides facing the ice tank. The air is thus cool and dry before it enters circulation in the car. The amount of air admitted is only sufficient to replace the weight of the lighter gases collecting in the top of the car and passing out through the outlet vents. As these gases are not only heavily charged with moisture but carry a considerable amount of heat resulting from bacterial action, the ease with which the proper conditions of refrigeration may be maintained is considered to be more than an offset for the amount of heat which must be removed from the replacement air.

As an inspection of the drawing will show, the Clinton Eliminating System consists essentially of but two parts, the gas collecting duct attached to the ceiling of the car and the ice tempering pans which are attached to the end lining of the car and occupy a portion of the space between the lining and the ice tanks. It will be seen that the system may, therefore, readily be installed in existing refrigerator cars with only minor alterations in the car structure to accommodate the inlet and outlet vents.

This system has been installed in a number of cars of the Cudahy Refrigerator Line. The service of this equipment during the last hot season was satisfactory in that it has demonstrated the correctness of the principle of the system as a means of greatly reducing the rate of decomposition of perishable products, and more cars are to be equipped.

Combustion Recorder for Flue Gases

IT IS a well known fact that the proportion of carbon dioxide (CO_2) alone in flue gases is not a sufficient indication of efficient boiler operation. This is true because the correct proportion of CO_2 varies with the kind of fuel used, the method of firing, the amount of air admitted, etc. For example, a proportion of 15 per cent of CO_2 might be allowable in one boiler installation, whereas another

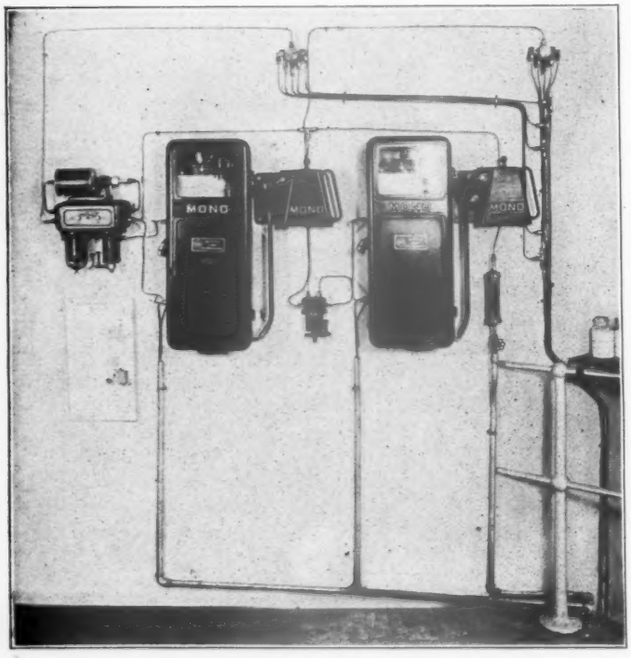


Fig. 1—Installation of C O₂ and C O Combustion Recorder in Boiler Room

boiler, using a different kind of coal, would be operated most efficiently with a lower percentage of CO_2.

The presence of any carbon monoxide (CO) is an indication of inefficient boiler operation and the best way to be sure no CO is going up the stack is to measure it, simultaneously with CO_2. A combustion recorder that measures both CO_2 and CO has been developed by the Mono Corporation of America, Buffalo, N. Y., and is illustrated in Fig. 1. With the use of this recorder it is impossible for the boiler room force so to manipulate the dampers that a high CO_2 reading is obtained without showing up at the same time a high proportion of CO. The fuel must be so burned that the

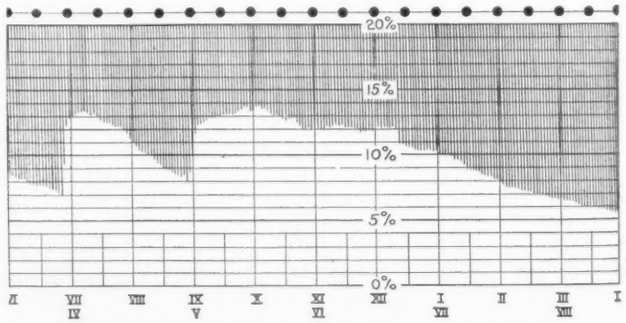


Fig. 2—Chart Showing Percent of C O₂ in Flue Gases

percentage of CO_2 is as high as possible without showing up any CO. In this way complete combustion is effected.

The device shown at the left of Fig. 1 is called the monoxide auxiliary type K, which, coupled with the standard CO_2 recorder permits the recording of CO. Charts showing the proportion of CO_2 and CO are illustrated in Figs. 2 and 3. When taken simultaneously these charts give an accurate account of furnace conditions.

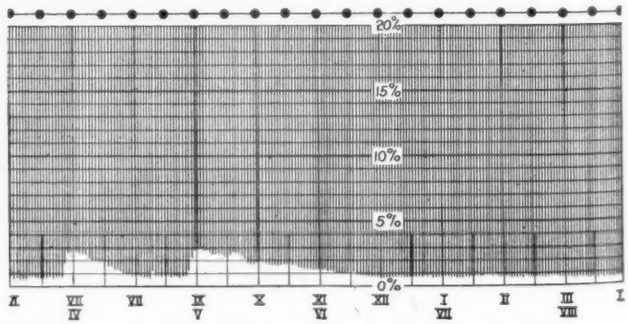
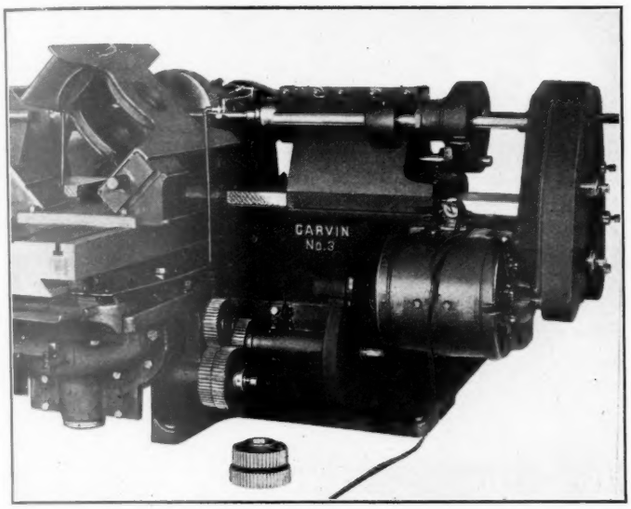


Fig. 3—Chart Showing Percent of C O in Flue Gases

Machine for Milling Crosshead Keyways

A MACHINE designed to mill the keyways in all classes of locomotive crossheads and piston rods, has been placed on the market recently by the Garvin Machine Company, New York. The two keyway slots in a steel crosshead vary in size up to 1⅞-in. wide by 4⅞-in. long by 5 in. deep and the difficult job of machining them is readily



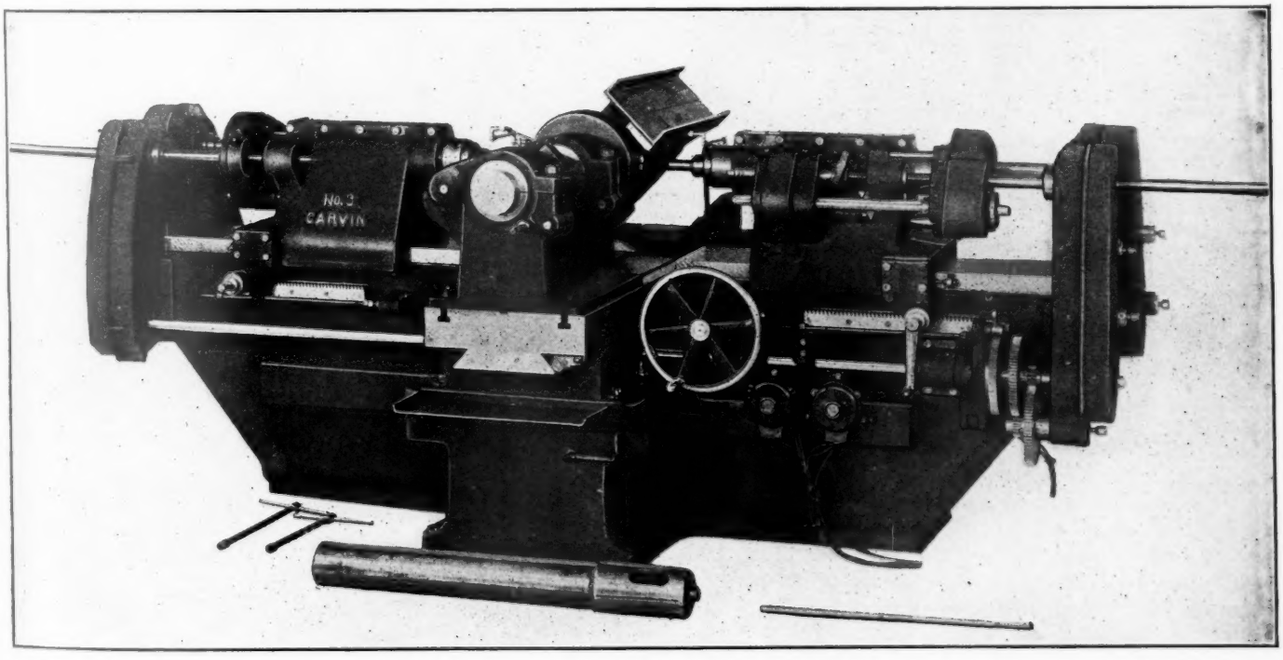
Rear View Showing Motor Drive, Change Gears and Angular Positioning Block

accomplished on the machine illustrated at the rate of one crosshead per hour. A 5½-in. piston rod keyway can be machined in one hour also, as has been demonstrated on one of these machines installed in a large railway shop in the east. With piston rods, the work is swung around at an angle to provide the necessary taper; and when the slot is nearly through, one cutter automatically retreats and the other continues to advance, completes the slot and then stops feeding. The work moves and the cutters are fed in from each side.

A fixture is provided to hold the crosshead on a mandrel, as illustrated, with some adjustment lengthwise, and a rear block to register the angular position of the keyway with the guide ways. The same fixture is used for the piston rod, but with a diagonal tongue piece to give the required taper. This fixture is used for all sizes by bushing down. The work is mounted on a heavy table and traversed by an adjustable crank pin and block, both hardened, moving in a hardened slot carried on the bottom side of the table. The crank stands vertically and is driven by a large bronze worm gear running in oil.

The cutters are held in two sliding sleeves carried on adjustable headstocks fitted to the bed. The heads can be run back to get the cutters out of the way when mounting the work, and then run forward to fixed stops. Each sleeve has a maximum feed of six inches and an automatic trip. The cutter sleeves are run forward and back simultaneously by hand, by a large handwheel at the front. The cutter spindles are fitted with positive driver slots for cutters and the front bearing is tapered, running in a solid bronze box. The rear bearing is straight, fitted with an adjustable bronze box.

The bearings of the sleeves in the heads are split the whole length to regulate the tightness of the sliding fit. The in-feed of the cutters takes place at each end of the stroke, and varies from .010 in. to .025 in. by an adjustable pawl and ratchet. An automatic trip is provided to lift the pawl out of action and stop the feed of the cutters when the proper depth is reached. The machine is driven by two five-horsepower, three to one variable speed motors with push button control, arranged so that if one motor fails the other will stop. All feeds and drives are positive except the oil pump.



Garvin No. 3 Duplex Slot-Milling Machine

The adjustable crank for moving the table can be adjusted by a wrench at the rear and set by a scale on the moving table.

Change gearing is provided to regulate the number of

strokes per minute of the table in relation to the length of slot and diameter of cutter being used. The cutters run 70 ft. a minute, with a maximum in-feed of .020 in. on large cutters, two-prong fish-tail cutters being used. The table moves at the rate of 18 in. per minute at mid-stroke. For milling a through slot as in a piston rod, the right-hand head carries a special screw that can be thrown into action, and this screw advances towards the right at the same time that the sleeve feed screw is advancing towards the left. At the proper time the feed nut of the sleeve screw is unlatched and the special screw meets the feed screw head, pushing the feed screw and spindle sleeve back bodily; while the left-hand cutter continues to advance. When the left-hand cutter has cleaned up the slot the automatic trip lifts the feed pawl out of action. The feed nut is relatched and the cutters resume their original positions, when the cutters are run back by hand.

A strong stream of lubricant to wash the chips out of the slot is provided for each cutter with a necessary oil trough and reservoir. Intermediate cloth gears are used to reduce noise and all gearing is thoroughly protected. The method here used of light cuts and fast traverse is more rapid than heavy cuts and slow feed, and is not limited so much by the depth of cut. The machine can be used for cutting keyways, cutting out fork ends in rods and other work of a similar nature.

Laminated Glass for Car Windows

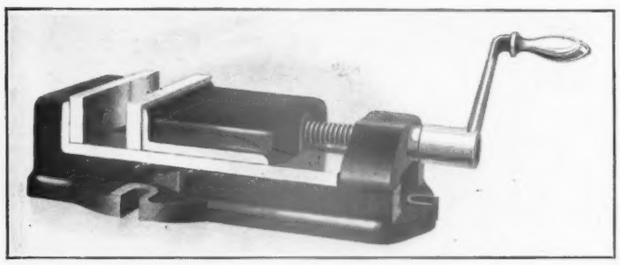
A NEW type of laminated safety glass has been invented recently and placed on the market by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. This glass consists of two sheets of ordinary glass, between which is interposed a thin sheet of pyroxylin plastic. Hydraulic pressure and the application of the proper degree of heat welds the glass and the pyroxylin sheet together in a solid unit. The pyroxylin binder prevents any scattering of fragments in the event of violent breakage of the glass.

In a recent test, a nickel jacketed revolver bullet fired from a distance of seven feet failed to penetrate a sheet of this laminated glass. The transparency of the glass, it is claimed, is not appreciably reduced by the insertion of the plastic sheet. It is proposed to introduce the glass extensively for use in car windows or wherever fragments of broken glass will cause personal injury, should a window be broken either accidentally, or maliciously, as by small boys throwing stones.

Hoosier Plain Drilling Machine and Vise

A 16-IN. plain drive vertical drilling machine designed for light and medium work has been developed by the Hoosier Drilling Machine Company, Goshen, Ind. Maximum simplicity together with convenient operation has been secured in this machine. All gears are machined and carefully fitted. Particular attention has been paid to the spindle alinement and to securing ample lubrication of all bearing surfaces. The drill is driven by a belt from the main shafting and is started and stopped by means of a foot-operated belt shifter. Cone pulleys provide a range of five spindle speeds. Either a round or square table can be provided.

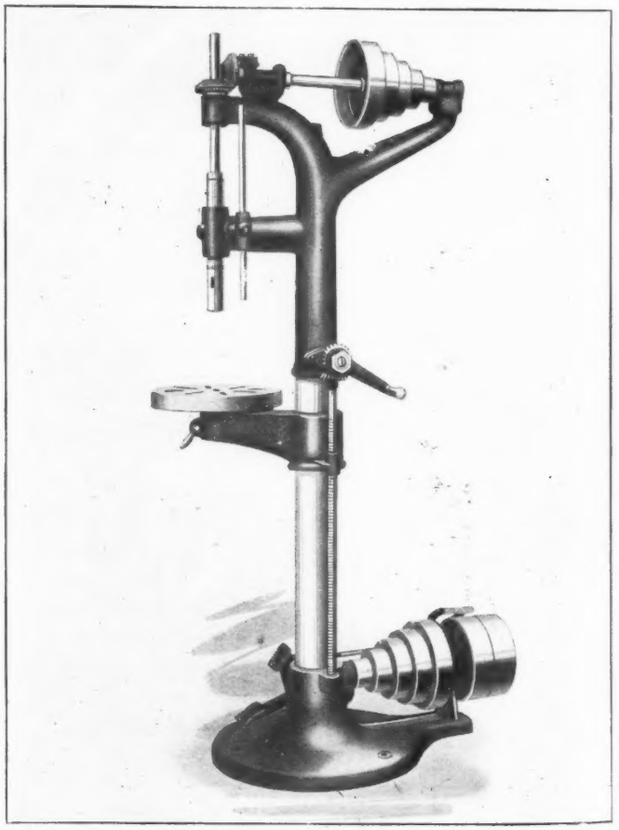
It is possible to drill to the center of a 16-in. circle, the distance from the column to the center of the spindle being eight inches. The maximum distance from the spindle to the table is 28¾ in. and from the spindle to the base 44¾ in. The spindle travel is 8½ in. The machine consumes about one horsepower and the speed of the driving pulley should be approximately 300 r.p.m. This allows a range of spindle speeds including 46, 172, 300, 521 and 971 r.p.m.



An Adaptable Vise of Rugged Construction

Detachable Vise

The vise illustrated is intended for use on drilling and milling machines, but can be used with equal success on shapers or planers. Like the vertical drill described above, the vise is simple in construction and strong. The jaws are faced with hardened steel. On the bottom of the vise body a milled key slot runs the entire length of the body and insures correct alinement when the vise is anchored to a milling machine table. Flanges with bolt slots are provided on the body of the vise so that it may be securely anchored to the table.



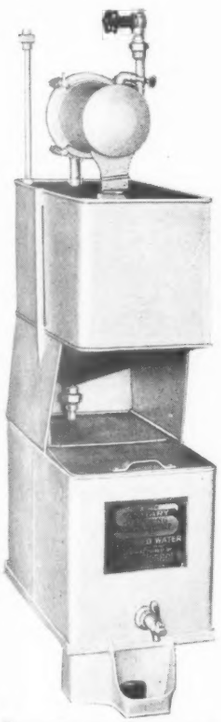
Hoosier 16-Inch Vertical Drill

North Pole Sanitary Drinking Fountains

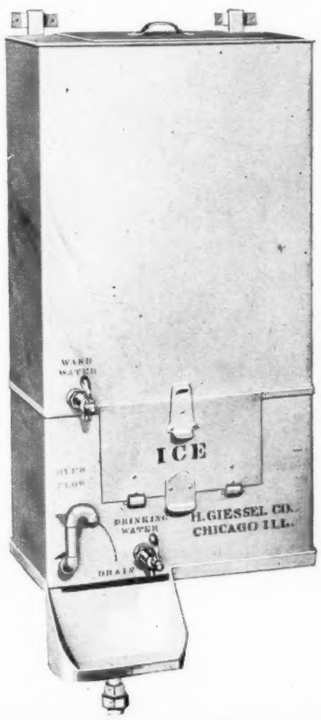
THE Henry Giessel Company, Chicago, Ill., has developed and placed on the market several types of drinking fountains that have proved to be a sanitary and economical part of railway equipment. These fountains are of very substantial construction, effect a considerable saving in the amount of ice used and require only a minimum of attention at terminals.

Special Cooler for Locomotive Tenders

There are several designs of this fountain for use in passenger carrying equipment, one of the latest types being shown in the illustrations. The fountain for passenger coaches consists of a filter, shown at the top, a storage tank having a capacity of seventeen gallons and an ice chamber containing a cooling pan with a capacity of three cups so that only the water that is being used is cooled, thus effecting a great saving in the amount of ice required.



Fountain for Mail Cars



Type Used in Baggage and Express Cars

A fountain designed for use in mail cars which is made with or without a filtering apparatus is also shown and, being similar in construction to that used for passenger coaches, furnishes the employees of the railway mail service with sanitary drinking water. The fountain proper consists of a storage tank for filtered water and an ice compartment in the bottom of which is placed the cooling pan through which the water flows from the storage tank to the faucet. The water supply is drawn from the overhead tank of the car and, by gravity, passes through the filter on the top of the fountain into the storage tank and thence into the cooling tank.

These fountains require no steaming or cleansing during train operation as all that is necessary is to change the filter stones at terminals every seventy-two hours, simply replacing the stones with freshly sterilized ones. This operation requires only about ten minutes per car, the thorough cleansing and sterilizing of the entire apparatus being necessary only at infrequent intervals as the use of freshly sterilized filter stones meets all of the sanitary regulations in the various states and has been favorably passed upon by the United States Board of Health. However, provision is made for convenient and thorough cleaning of all parts of the cooler. By the removal of five clamps, the filter casing may be removed and the filter stone taken out by unscrewing the pipe connection with which it is attached to the fixed end of the filter case. It is then easily and thoroughly cleaned by steam or by submerging in hot water. An opening is provided on

Porcelain Enameled Fountain for Passenger Coaches

the front of the storage tank near the bottom which is closed by a plug. Removal of this plug permits the interior of the tank to be cleaned by the insertion of a steam nozzle.

To drain the system, a cock is opened in the bottom of the cooling tank which permits the water in the storage tank to flow directly into the ice chamber and thus out through the drain.

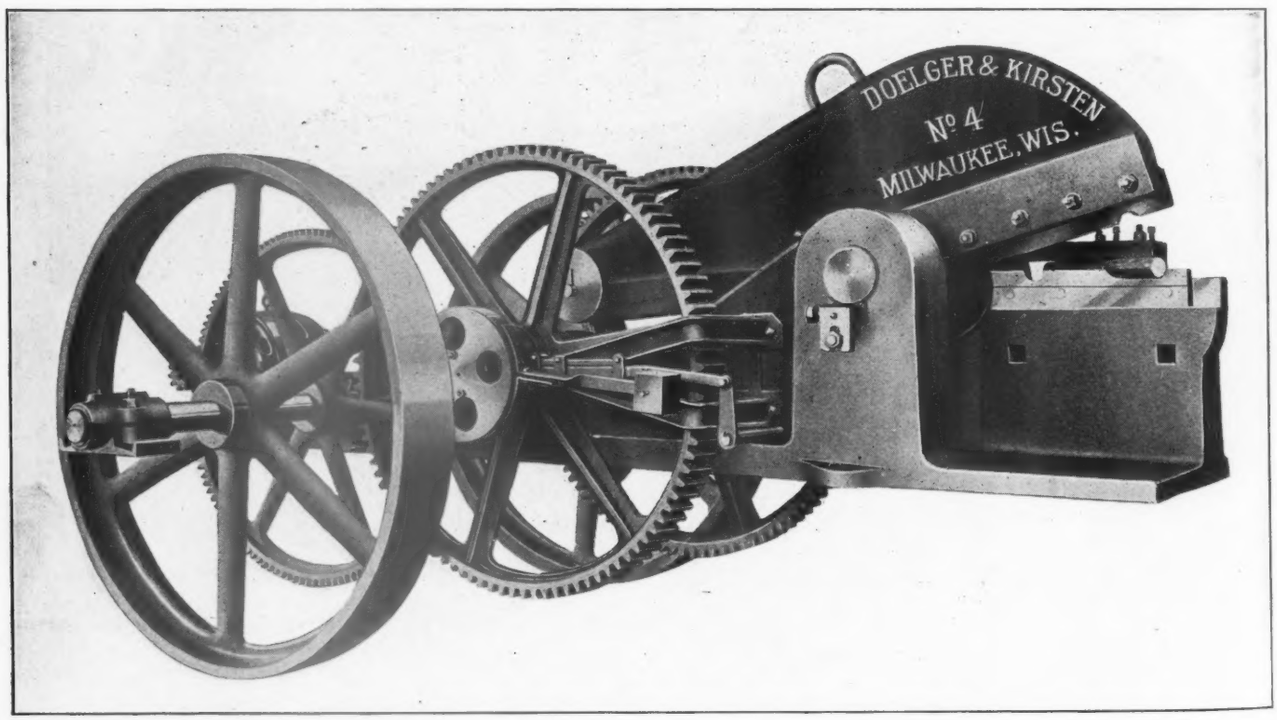
An adaptation of this fountain for baggage, express and other cars where drinking water may be required is also shown which, in addition to the supply of drinking water, provides a tank for wash water.

In addition to the three tanks already mentioned, this company also manufactures a portable tank for locomotive tenders. This tank has an ice compartment as in the other fountains and thus provides pure water without contamination from ice which may be secured from sources where it is impossible to eliminate cinders or other impurities. In this tank, the melted ice drains off and, as only a small portion of the water is in contact with the ice at any one time, the economy of the cooler is apparent. As shown in the illustration, a bracket is permanently attached to the tender and sockets are provided on the tank so that it may be securely suspended from the bracket and thus withstand the shocks incident to the operation of the locomotive.

A filter operating in a manner similar to the filter used with these fountains, is manufactured by the Giessel Company for use in conjunction with the Giessel standard cooling pan and makes a complete filtering and cooling apparatus for dining cars. These filters and fountains are in use on a large number of railroad cars on a number of the larger railroads in the United States and observations made by two of the largest roads show that twenty-five pounds of ice is sufficient for a run of five hundred miles. These fountains are made of cast iron, white porcelain enameled, are easily kept clean and add to the interior finish of a car. They are economical in the use of ice.

Alligator Shears for General Work

A LINE of alligator type shears which can be used to good advantage in railway blacksmith shops, scrap docks and reclamation plants, has been developed and introduced recently by Doelger and Kirsten, Milwaukee, Wisconsin. The machines are made in four sizes with jaws varying from 21 to 30 in. long and bar stock up to 5 in. square can be cut on the No. 4 shears. The machine, illustrated, is exceptionally rugged in construction and designed to withstand all stresses incident to the severe nature of the work performed.



Alligator Shears Cut Round Stock at an Angle Without Deformation

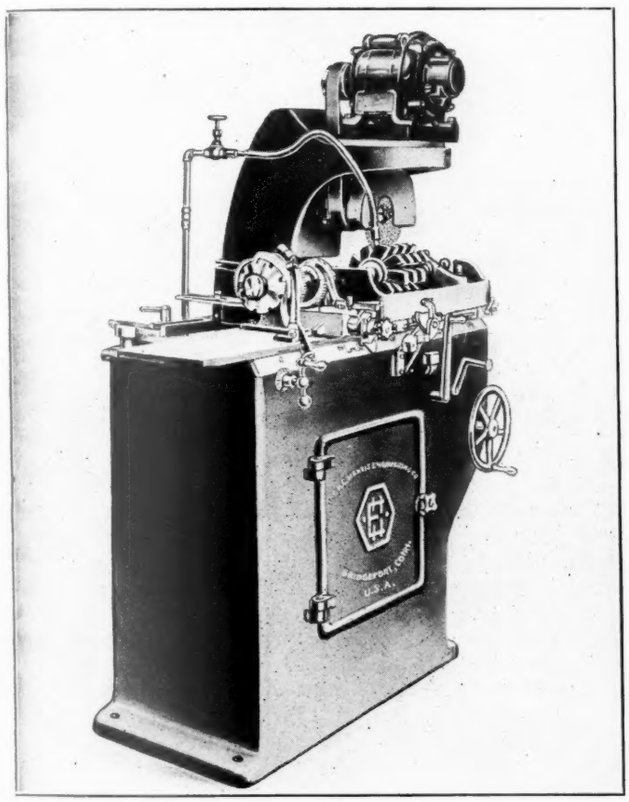
An important feature in the construction of this line of alligator shears is found in the automatic attachment by means of which the operation of a foot lever trips the clutch and causes a full stroke, the machine stopping automatically at the end of the revolution. The work may be fed to the shears from either side and it is possible to cut boiler plate as well as bar stock. Large gears on both sides of the crank shaft, are used as drive gears and their size and weight insures a strong, well balanced drive. The automatic arrangement by which the machine stops at each stroke, allows sufficient time for careful measurement of the work before the machine is again operated.

Particular attention is called to the arrangement by which round stock can be cut at any angle up to 30 degrees. This feature is of value for many operations as, for example, in the manufacture of chain links. Doelger and Kirsten No. 4 alligator shears have been installed at one plant to cut 5½ inch round iron bars at a 30 degree angle in making chain links. In this case, a clean cut surface for welding is secured and no loss of time occurs due to the blacksmith form-

ing the 30 degree angle on each link by hand. Cutting the stock at any angle is made possible by the use of suitable dies. The dies required depend upon the kind of work desired to be done and they are essential particularly in cutting round stock. With the dies, it is possible to cut round stock well within 5 per cent of the perpendicular and the end of the stock is not deformed. This feature is particularly valuable for certain kinds of work.

Motor-Driven Automatic Hob Grinder

THE latest addition included in the line of precision grinding machines manufactured by the H. E. Harris Engineering Company, Bridgeport, Conn., is an automatic hob grinder. This machine is furnished either as a belt- or motor-driven machine, the former being called No. 815-B and the latter No. 815-M. On account of the many advantages of machines equipped with unit motor drive the No. 815-M machine illustrated is a favorite with shop foremen and managers. It can be set up in the most convenient position, irrespective of shaft or group drive.



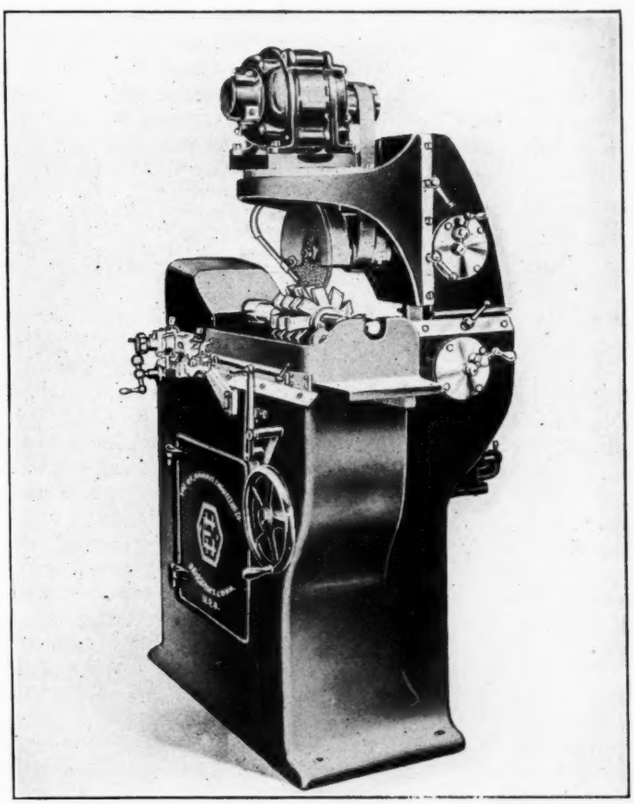
Harris Automatic Hob Grinder Arranged for Motor Drive

The motor for driving the wheel spindle is mounted above and upon a circular horizontal slide, the wheel head being mounted below on the same slide. The drive from motor spindle to wheel spindle is by an endless belt, the slack being taken up by raising the motor itself. This motor does no work except to drive the spindle and sudden torques from reversing or indexing do not affect it. The cutting face of the grinding wheel coincides with the vertical axis of the horizontal circular slide, so that when this slide is swiveled to the desired angle of the hob flute, the wheel is in the correct position. The weight of the motor adds to the stability of the machine and helps in absorbing vibration. Better results can be secured with this type than with the belt-driven machine. The ball crank handles, shown on the right of the column, control a fine and powerful vertical and horizontal adjustment to the wheel head.

For driving the automatic slack take-up device, the indexing mechanism, the self-priming pump and the table feed and reverse, a separate motor is located behind the machine base. The machine is provided with full automatic features throughout, including indexing, reversing, feeding the hob a predetermined amount after each revolution, and stopping when the desired amount has been ground off.

Hobs not exceeding 8 in. in diameter by 10 in. long can be ground. It makes no difference whether the flutes are straight or spiral, both right and left hand spindles being taken care of by the ball crank handle on the left of the machine. This controls a fine adjustment through worm gear, pinion and sector to the forming slide, which is coupled to the work spindle. The hob rotates the required amount to provide helical movement during the longitudinal movement of the work table. The adjustment can be made while the machine is running. Indexing is done automatically.

The table travel can be operated either by hand or automatically. The short lever on the extreme right controls the automatic table feed and reverse mechanism. A diamond truing device is arranged for truing either side of the grinding wheel to any angle required, also the periphery of the wheel. It can be used without interfering with the set up of the hob or cutter in the machine.



View Showing Handles for Wheel Head Adjustment

After the hob has been set up and the machine started, an automatic adjustable feed is provided which will grind off the face of the teeth the required amount at each stroke. Provision also is made so that a predetermined amount may

be ground automatically through successive revolutions, when the machine stops automatically.

One unusual feature of the machine is an ingenious device providing a uniform pull to take up all slack in the spindle indexing and spiral generating mechanism. This permits the grinding wheel to operate on both strokes.

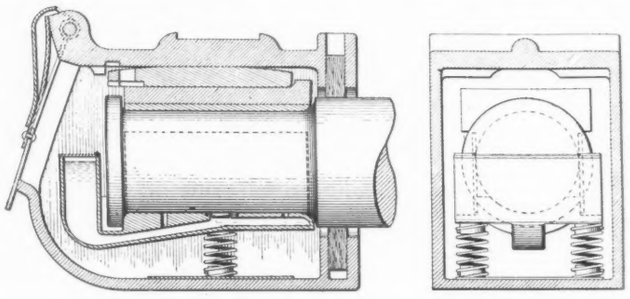
It is claimed that by the use of the Harris automatic hob grinder the life of hobs will be increased materially, for the cutting teeth are accurately and evenly ground, the minimum amount of material is ground away at each stroke, there is no crowding or burning of the hob teeth and the profile or temper of the teeth is not destroyed. An ample supply of cutting lubricant is furnished and provides greatly increased machine output when necessary.

Grease Lubricator for Journal Boxes

A DEVICE for holding and distributing hard grease to car journals has been developed for application to the standard journals and journal boxes in place of the usual oil soaked waste packing. It has been tried out successfully in passenger service.

The illustration shows the form of the lubricator and the method of applying it to the journal box. The lubricator consists of a brass casting, the grease reservoir extending up in front of the journal collar and the distributing surface being fitted to the under side of the journal bearing. It is held in place against the journal bearing by two coil springs, the upper ends of which fit over lugs on the bottom of the lubricator, while the lower ends are held in position over lugs on a plate, resting on the bottom of the journal box. In an opening in the face of the lubricator bearing against the journal is fitted a small roller which serves partially to distribute the grease to the journal surface. Grease is also fed to the journal through holes drilled through the bearing surface of the lubricator. The journal is protected from dirt by two pads attached to the sides of the lubricator, extending upward against the sides of the journal to the lower edges of the brass. These shields or pads also serve to hold and distribute the lubricant over the journal when it is in motion.

Like all grease lubrication, the operation of the device depends on a sufficient rise of temperature of the journal to soften the grease and permit it to flow freely. The reservoir opening, located in front of and at about the center of the journal collar, is readily accessible for refilling by opening the journal box lid.



A Journal Box Lubricator Using Hard Grease

The patents on this device are owned by T. J. Holmes, Chicago.

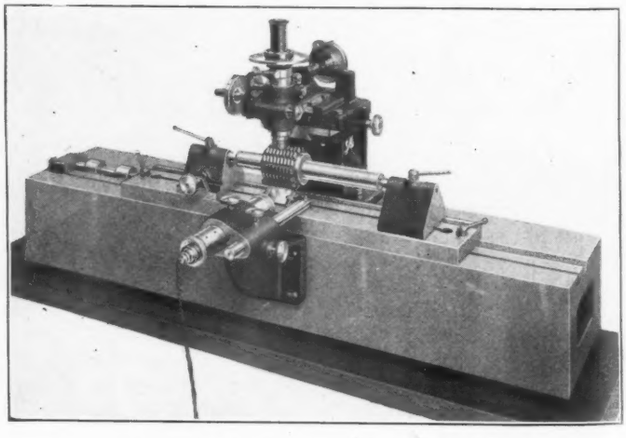
Screw Thread and Gage Checking Machine

CONVENIENT and accurate means for checking the measurement of screw thread tools, formed tools, gages, etc., is provided by a microscopic measuring machine which is being introduced to the American market by Alfred Herbert, Ltd., Coventry, England. The machine is well adapted for measuring lengths, angles and pitches. It does not depend on screws for its accuracy, but upon end measuring rods and large dial micrometers. It consists of two main parts, including a rigid box-bed carrying a table capable of 12-in. movement by accurate amounts through the insertion and removal of standard hardened steel measuring rods of known length between flat contact pieces. A pair of centers also is provided, one of which is adjustable in a crosswise direction to enable work to be lined up accurately.

The other part of the machine consists of a microscope with vertical movement by means of a rack and pinion for focusing, and mounted on a compound slide rest, with screw movement parallel with the slides and at right angles to the table slide. The microscope is fitted with two hair lines across its diameter, one rotating with the outside tool and the other rotating with the eyepiece. The outer tube carries a large dial, carefully graduated in half degrees, and the eyepiece carries a vernier, which enables readings accurate to one minute to be made. Thus the angle between the two hair line can be indicated with great accuracy.

A light projector is fixed to the machine to project parallel rays of light through a lens onto a mirror placed at an angle, and so past the work. When measuring threads this attachment eliminates all shadows and the light projected from the flanks of the thread which tend to make the object indistinct. The mirror is adjustable to suit the lead of the thread and enables the object to be clearly defined through the microscope.

In making a plain length measurement the work is clamped on the table and the table is clamped to the bed with a measuring rod held firmly between the two contact pieces. The microscope is then focused on one end of the piece or part to be measured, with the hair lines covering a defined point from which the measurement will be made. The measuring rod is then substituted by another and the table adjusted and reclamped. By looking through the microscope it is quickly seen whether the part to be measured



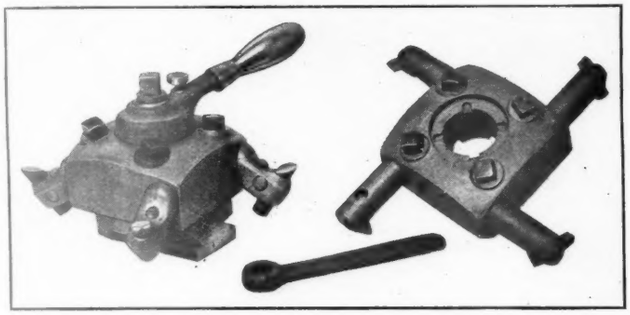
Herbert Microscopic Measuring Machine

corresponds with the difference between the lengths of the two measuring rods. If it varies, the compound slide can be adjusted until the hair lines cover the second point that should have come immediately under them if the part had been correct. The micrometer on the compound slide registers the error.

For the checking of gages, master templates, pitch, depth and shape of screw threads the machine illustrated is exceedingly accurate. All angles are checked by angular adjustment of the hair lines and irregular shapes are checked by a series of straight line measurements combined when necessary with adjustments of the hair lines.

Turret Tool Post for Engine Lathe

A TURRET tool post, designed to be used on engine lathes, has been produced recently by the Lovejoy Tool Company, Inc., Springfield, Vt. It is rigidly constructed, convenient in operation and compact enough to be used on any lathe having a center height above the tool rest of over 1⅜-in. A positive lock is incorporated in the turret. The turning and facing cutters are adjustable for height as they become worn; this feature permits of keeping the cutting edge on center without sacrificing strength and rigidity. The tool overhang has been reduced to a minimum.

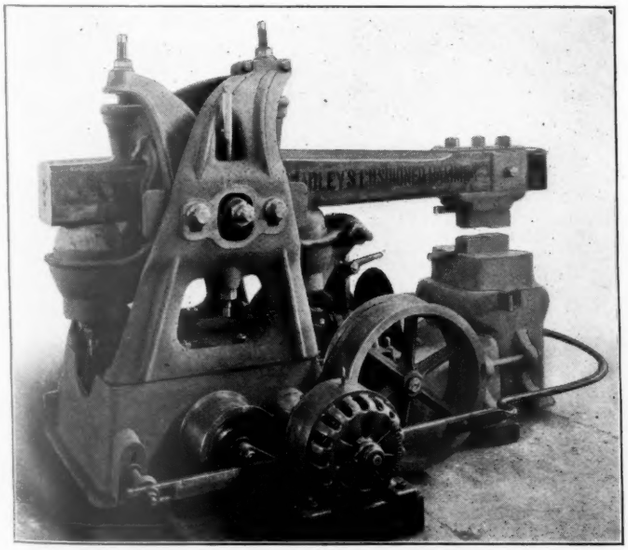


Lovejoy Turret Tool Post

By one movement of the binding lever the operator releases, accurately indexes to the next tool post, and again rigidly clamps the turret to its base, an operation quickly accomplished by one hand. The turret rings are approximately 4⅜ in. square, made of hardened steel and are interchangeable on any base. This feature permits the use of additional rings, carrying a variety of tool combinations for various jobs. One of the rings is provided with boring bars one inch in diameter as shown in the illustration. These are entirely free from projections to interfere with chip clearance and will cut to the bottom of a hole slightly larger than the bar itself. The toolpost will instantly interchange with any regular engine lathe toolpost without special fitting of the lathe. It is only necessary to submit dimensions of the toolpost saddle with the order.

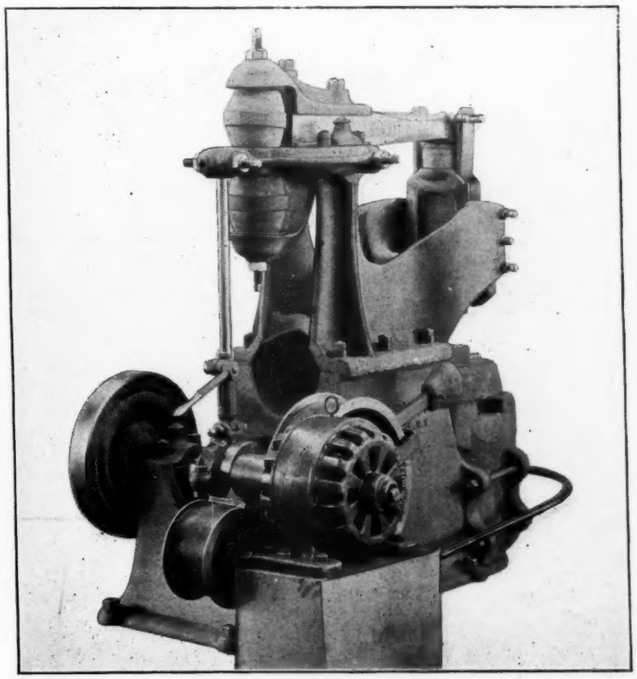
Motor Drive Applied to Power Hammers

CONVENIENT arrangements of motor drive applied to the power hammers manufactured by C. C. Bradley & Son, Inc., Syracuse, N. Y., are shown in the illustrations. Where there is an objection to the use of overhead shafting or where the blacksmith shop is isolated from the main power plant this arrangement can be used to good advantage, a compact and efficient motor drive being secured.



Bradley Hammer With Driving Motor Mounted at the Side of the Machine

The motor is mounted on a block adjacent to the machine and drives through a loose belt and idle pulley between the motor and hammer. Pressure on the foot treadle engages the idler and starts the hammer, also regulating the force of the blow. On the 200-lb. hammer, a counterweight balances the idle pulley. This insures that practically all pressure applied to the foot treadle is transmitted to the idler.



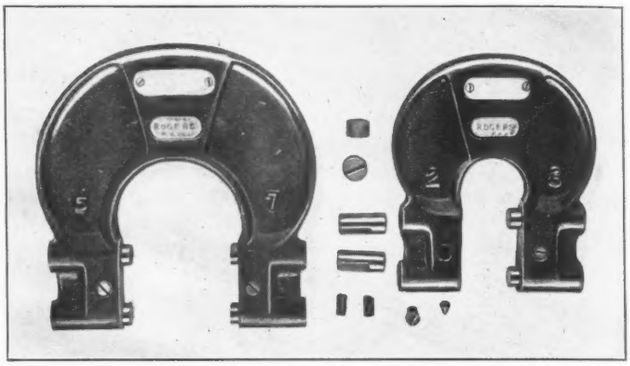
200-lb. Bradley Hammer With Driving Motor at the Rear

Adjustable Limit Gage Aids Inspector

ONE of the latest gages produced by the John M. Rogers Works, Inc., Gloucester City, N. J., is the adjustable limit snap gage illustrated, which is convenient for accurate inspection work. Gages of this type are made in 22 different sizes, the smallest of which has a range of from 0 to ¼ in., while the largest has a range of from 8 to 8½ in. The frame of the gage is double ribbed to afford extreme rigidity, a most important feature in a tool of this kind. The anvils are made of alloy steel, hardened, ground and lapped to afford durability and accuracy. Marking tags showing the sizes are made in the form of separate brass plates screwed to the frames of the gages, and extra tags may be furnished when they are required.

Before being machined the malleable iron castings are well seasoned to guard against danger of warping after the gages have been finished. All of the gage plugs are carefully lapped, both on their diameters and gaging surfaces. This accuracy in sizing the diameters of the plugs enables them to fit snugly into the holes in the frame, which are line-reamed to assure parallelism. The plugs are so designed that they cannot turn in the frame. The adjusting screws have a fine pitch thread, which permits of making accurate adjustments. A master locking device in addition to firmly setting both anvils with one master screw can also be set to hold a slight tension equally on the anvils while adjustments are being made. When the master locking screw is firmly set the space provided over the head may be sealed, making the gage proof against tampering.

It is an easy matter to set the plugs to any dimension



Rogers Adjustable Limit Gage

within the range of the gage by using a standard measuring plug block, or disk. When the plugs become worn and require repairing it is only necessary to grind the ends on the wheel and lap the surfaces down perfectly square.

Crank Shaper With Wide Cross Rail Guides

THE 20-in. back geared crank shaper, described and illustrated in this article, has been placed on the market recently by the Whipp Machine Tool Company, Sidney, Ohio. This machine is made in 16-in. and 20-in. sizes

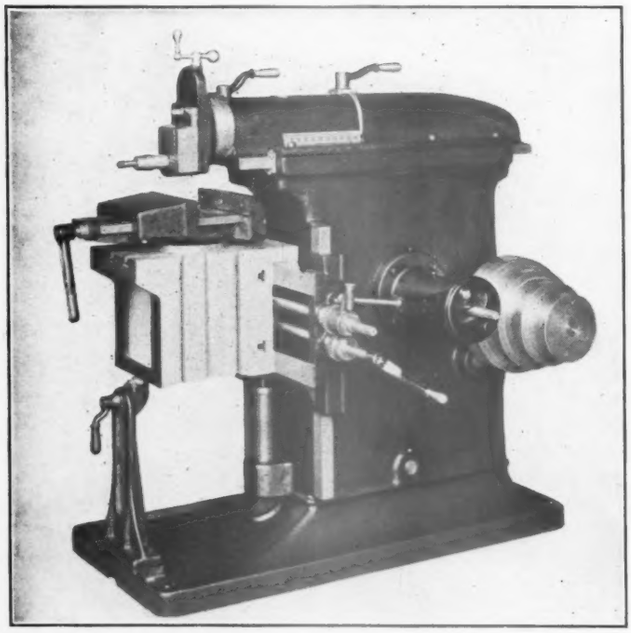


Fig. 1—Whipp 20-In. Crank Shaper

and a particular feature is the unusual width between the cross rail guides, more plainly indicated in Fig 2. The wide guides on the column form a pair of external ribs, which provide unusual column stiffness and rigidity. At the same time, a wide guide is provided for the cross rail itself, so that the work never overhangs the guides.

Particular attention is called to the arrangement for supporting the cone pulley shown in Fig. 1. In this design the

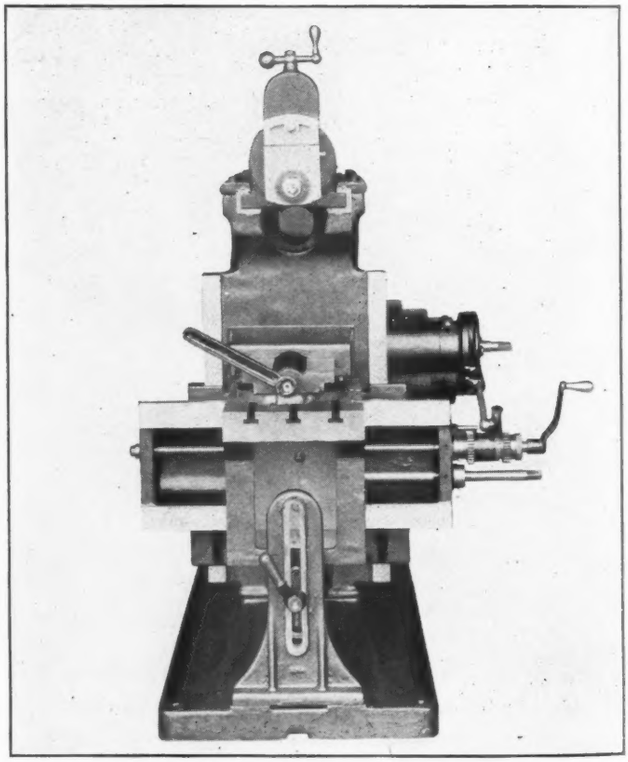


Fig. 2—Showing Unusual Width Between Cross Rail Guides

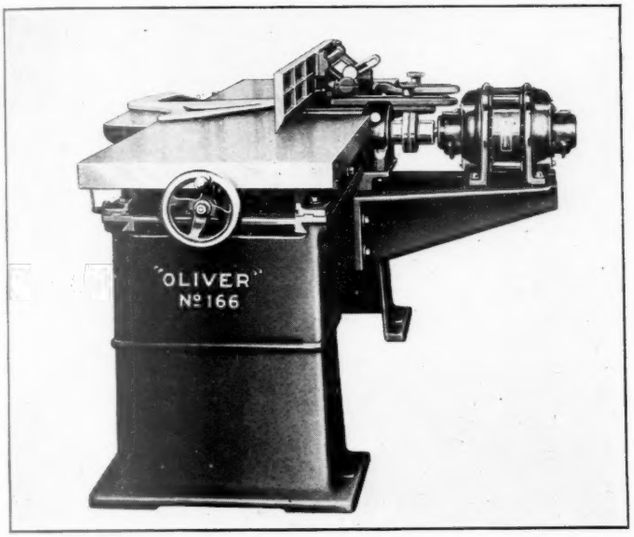
hub of the cone pulley is flush with the small end of the cone which allows the bearing in the column itself to extend nearly to the center of the cone. This assures a much stiffer

bearing than would be the case where an outboard support or sleeve bearing is used. Correct alinement of the pulley and shaft is maintained under heavy belt pull, a most important advantage.

An eccentric locking bolt is provided for locking the swivel plate to the head. This holds the head solidly to the ram and at the same time provides a quick and easy method for releasing when the head is to be swiveled.

The shaper base is arranged to prevent oil from dripping on the floor. Extension of the ram guides at both the front and rear of the column provides a long ram bearing and to secure accurate alinement, the elevating screw nut is carried in the main column casting. A table support may be furnished with the shaper and applied to the base extension as illustrated. This arrangement increases the rigidity of the table under heavy cuts.

New Driving Arrangement for Hand Planer



Hand Planer and Jointer Arranged for Direct Motor Drive

FOR some time hand planing and jointing machines placed on the market by the Oliver Machinery Company, Grand Rapids, Mich., were arranged with the motor built into the machine. This arrangement, however, did not permit of sufficient flexibility, inasmuch as the machine could be used only in a shop provided with the particular electric circuit for which its motor was designed.

In order to overcome this difficulty a new type of drive connection has been developed, which permits the use of any type of electric motor, provided its speed is approximately 3,600 r. p. m. In other words, the machine illustrated can be furnished with a motor to operate on direct current, or alternating current, with single, two, or three-phase voltage.

All belting is eliminated since the motor is directly connected to the revolving cutter head. The efficiency of the machine is increased on account of fewer bearings and no belting and the absence of belt guards saves considerable floor space. The machine is equipped regularly with three high speed knives in the head, which is of the Oliver round or safety type. On account of the high speed, the machine above described is capable of producing smooth work required in cabinet shops and pattern shops.

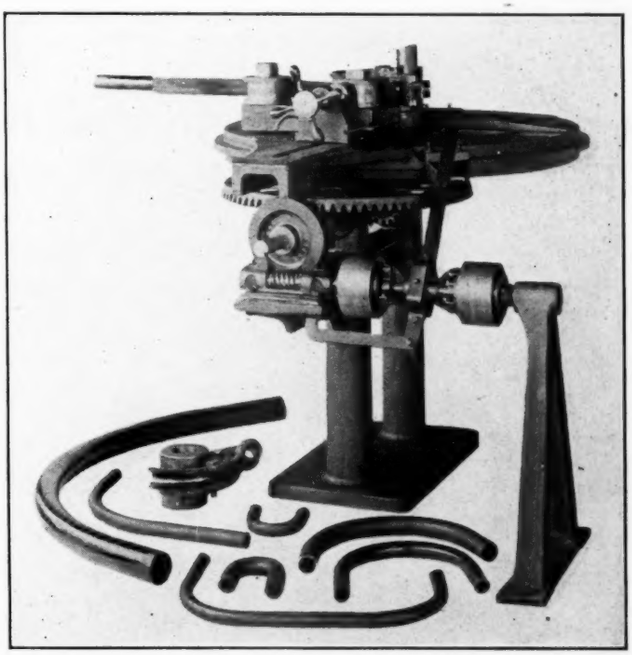
Pipe Bending Machine Is a Labor Saver

LOCOMOTIVE construction and repair work in particular, require a good deal of piping and in these days of high labor cost it is important that all shops be equipped with power-operated, pipe bending machines. The pipe bender, illustrated, is made by the Wallace Supplies Manufacturing Company, Chicago, and has a capacity to bend cold pipe up to two inches in diameter. Ordinarily no inside follower or floating mandrel is necessary, but these can be used when bending special forms.

The standard equipment furnished with the machine consists of four forming heads which may be used for bending one-inch iron pipe to an angle of 90 deg., with a six-inch radius; 1¼-in. pipe to an angle of 90 deg. with nine-inch radius; 1½-in., 90 deg. with 12-in. radius; 2-in., 90 deg., 14-in. radius. The pipe is secured to the form by means of a strap as indicated, and both the follower and the form are grooved with the proper clearance to secure the best results.

The outside follower bar operates between the tube and the roller instead of the roller working directly on the tube. This method supports the tube for a greater distance and obviates the depression which usually shows on the tube when the roller operates directly on the materials. The roller bracket is adjustable to take forms up to 50 in. in diameter and is operated on a screw to force the tube into the form and for holding the follower bar close to the tube. This is necessary in order to secure the best possible results.

The machine is operated by lever for forward and reverse friction clutch pulleys, with adjustable stops provided to suit any degree of bend required. The clutch is automatically thrown out of engagement at both the end of the bending operation and when the machine has been reversed to the starting position. Special forms with inside follower bars or floating mandrels can be furnished to order for bending light gage tubing to a short radius without flattening or crimping.



Wallace Pipe Bending Machine

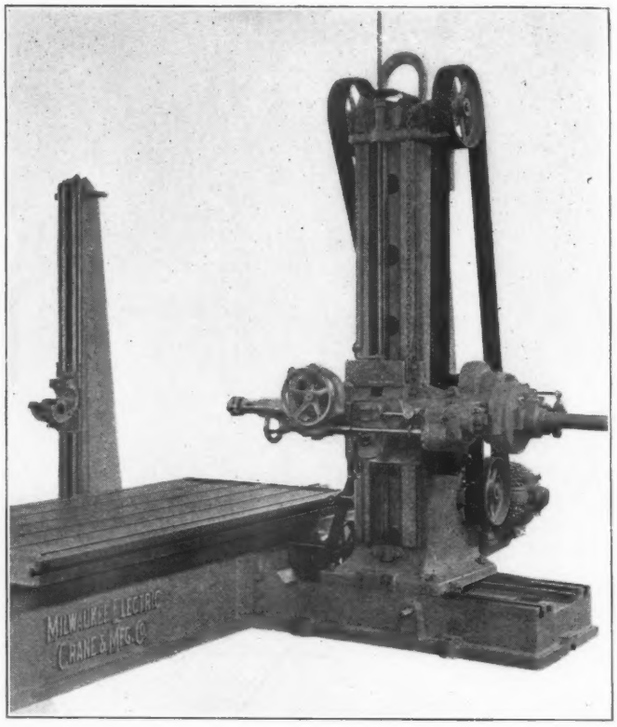
Horizontal Drilling and Boring Machine

A HORIZONTAL drill designed to cover a wide range of drilling and boring operations at one setting has been developed recently by the Malwaukee Electric Crane & Manufacturing Company, Milwaukee, Wis. By the use of this machine, it is possible to perform drilling operations on castings too bulky for the usual type of drill. Double setting of the work is avoided with a considerable saving of time, and the elimination of errors when boring holes for shafts or bearings, required to be parallel. Greater durability and accuracy in operation, as well as a more rapid change in speed and manipulation, has been secured by means of a direct-connected variable speed reversible motor. The arrangement illustrated provides high durability and efficiency and eliminates the use of gears in transmitting power from the motor to the spindle.

The spindle is of high carbon steel, accurately finished, the front end being fitted with a ball thrust bearing and a No. 5 Morse taper hole. Arrangement is made by means of a special cross key and nut for drawing up and releasing boring bars or tools. The spindle torque is not transmitted through the tang of the drill socket or boring bar when the work is heavy. The heavy rack teeth are arranged to automatically cut out the drive when the spindle reaches the extreme feed range. Danger of stripping the feed mechanism is thereby eliminated. The spindle is geared for standard speeds of 20 to 400 r.p.m. With a four to one motor speed range and 16-point controller, 32 different speeds are obtained with a single back gear ratio of five to one.

Six spindle feeds are provided for this drill from .009 in. to .070 in. per revolution. The feed is cut in or out by means of a trip lever and quick return or advance secured by the handwheel on the quill pinion shaft. The carriage elevating and lowering mechanism is operated by power or hand and the driving gear is provided with a limiting torque clutch as a safety feature. The hand adjustment is used only to secure final setting of the carriage. A steel scale on the face of the column indicates the distance from the top of the table to the center of the spindle.

The standard table furnished with the machine is 4 ft. wide by 9 ft. long and slides on a heavy planed cast iron bed. The table is power operated by a heavy screw capable of easy and accurate adjustment from both sides of the work. Suitable T-slots are provided for clamping the work or fixtures. All control levers are placed on the spindle carriage within convenient reach of the operator.



Milwaukee No. 25 Horizontal Drill Driven by 5-Hp. Motor

Small Pneumatic Hand Drilling Machine

FOR drilling staybolt telltale holes and other small holes, a drill developed by the Desoutter Brothers, Ltd., London, can be used to good advantage. The machine, shown in Fig. 1, is of novel design and takes the form of a cylinder 4 in. long by 1½ in. diameter, with the chuck protruding. It weighs only 1 lb. 14 oz. and takes drills up to ¼ in. The tool is grasped in the palm of the hand and the air supply is controlled by a press button in the head of the drill. The motor consists of a block of

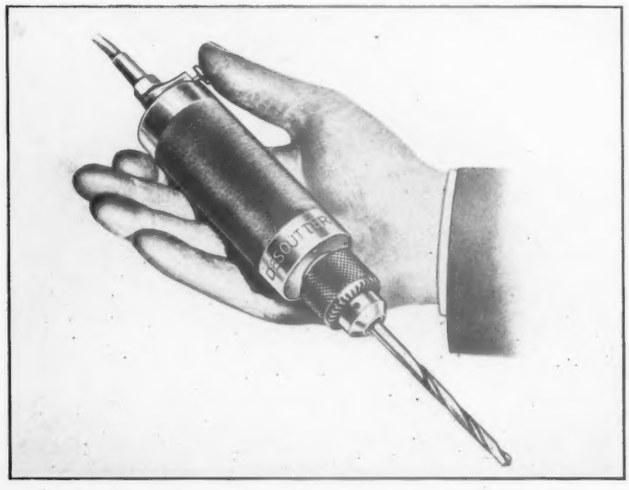


Fig. 1—Desoutter Pneumatic Hand Drill

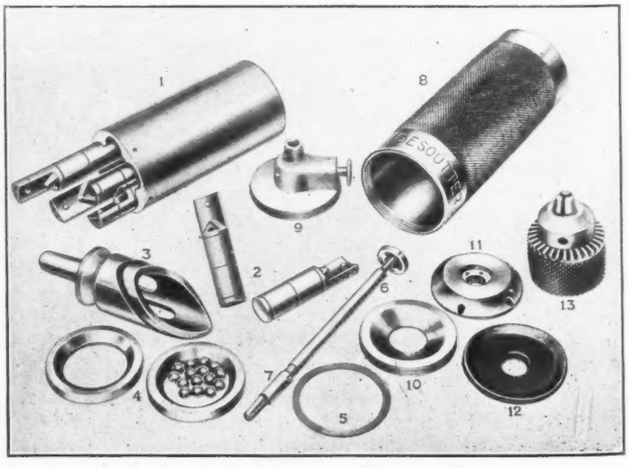


Fig. 2—Hand Drill Disassembled

five cylinders, of 7/16-in. bore and 1⅛-in. stroke, arranged symmetrically with respect to a control axis, with their bores *1*, Fig 2, parallel.

The piston for each cylinder is hollow and the working faces *2* are cut on the lower end to fit a specially shaped cam *3*. The cam is mounted so as to rotate about the central axis partly inside the recessed portion of the cylinder block, the pistons being operated in succession, controlled by a rotary type distribution valve *6*. This valve works on the circular valve face in the center of the cylinder head *11*. As each piston reaches the top and then the bottom of its stroke, the valve automatically admits air in the first case and permits the exhaust to take place when the bottom of the stroke is reached. This occurs with each cylinder in succession. There being five cylinders and pistons, a continuous motion is thus given to the cam. At the bottom of each stroke two small ports are exposed in each cylinder, which allow oil to be blown onto the cam face and ball race. The cylinder heads, valve face, inlet and exhaust ports are all in one piece, *11*.

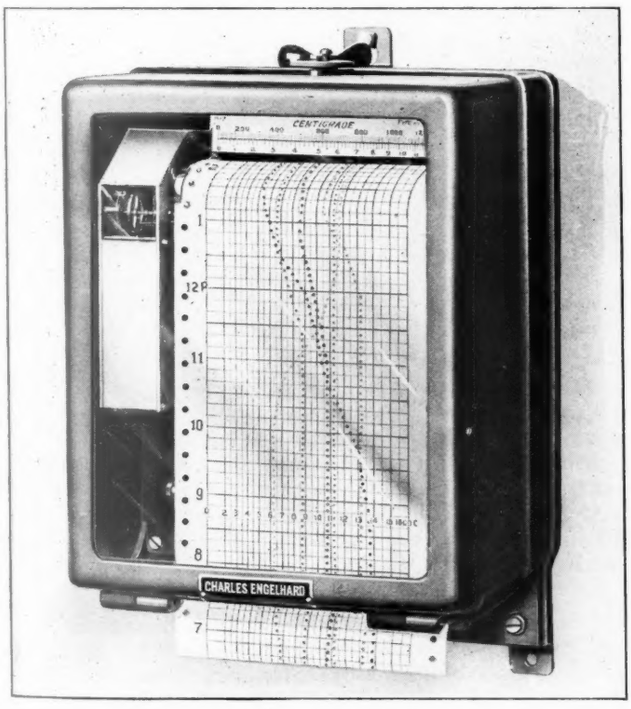
The cam rotates in a large ball bearing of which it forms the central member. Two large diameter outer races, fitted with balls of ample size, complete the essentials of the bearing. The thin steel ring, *5*, is a distance piece clamped between the outer races and forms the only adjustment required. The internals of the drill are kept in place by the screwed control valve housing *9* and the screw disk *10*. The chuck is kept on by a taper fit and screw.

An important factor in the efficiency of the drill, as far as air consumption is concerned, is the arrangement of employing one valve to control five cylinders, thereby reducing leakage to a minimum. Loss of air is also prevented by having the valve ports directly on top of each cylinder. Friction on the valve face is reduced to a small amount by a special balancing device. The form of construction of the cylinder block presents a means of getting the maximum power in the smallest space practicable.

The control valve is of the slide valve type, controlled by a push button. The rod of the press button acts as a piston, working through a small leather gland, the working pressure being used to force this outwards, thus automatically closing the control valve. The drill is well adapted for use in sheet metal shops and in fact any shop having many light hand drilling operations.

Pyrometer Recorder for Tool Room Use

MOST modern railway tool rooms are, or should be, provided with heat treating equipment including pyrometers, but in many cases no arrangements are made for pyrometer recording instruments. Several installations already made of these instruments have proved their value as an effective check on the tool maker. More uniform and better results in the heat treating of tool steel have been secured.



Engelhard Pyrometer Recording Instrument

A recording instrument designed to record temperatures registered by pyrometers has been placed on the market recently by Charles Engelhard, New York. With the idea of making it as thoroughly fool proof as possible this instrument is divided into two compartments, in one of which the sensitive moving system, carefully protected against accident, is mounted. In the front compartment, the clock and depressor bar mechanism as well as a direct reading scale is mounted, as indicated in the illustration. This construction eliminates danger of breakage if inexperienced or careless men replace the charts.

The charts are of the continuous roll type, approximately 100 ft. long, which allows records of practically any desired time length to be kept. The time-temperature lines are at right angles to one another, thus forming rectangular coordinates and a strictly proportionate chart. The temperature lines run longitudinally on the chart and the time lines across. The clock is provided with double main springs furnishing ample power and the chart drum, which drives the chart at its specified rate, is geared to the clock by interchangeable gears. Records are formed by a series of dots, an interval between dots corresponding to one minute. Therefore, on a four record instrument, a record is made on each thermo-couple once every four minutes.

A color carrying roller is located near the front of the instrument, just in back of and below the scale. It runs straight across the instrument, the chart coming up in back and over the color roller. The pointer swings just above the chart. Above the pointer is the depressor bar with its straight edge directly above the center of the color roller. When a record is formed, the depressor bar is allowed to fall upon the pointer of the instrument. It causes a record of the position of the pointer to be made by pressing the pointer against the chart beneath and squeezing the chart paper bebetween the pointer and the color roller underneath the chart. A small quantity of the pigment is taken up on the under side of the chart, which is transparent, allowing the color to show through clearly.

All contacts in the thermo-couple circuit are of silver with a heavy gold plate. The operation gives a wiping effect, insuring perfect operation of the contacts. Simplicity combined with careful design and construction of the pyrometer recorder insures accurate results and long life with reasonable care in handling.

CO-OPERATIVE STORES.—Information on how to start and conduct a co-operative store may be obtained from the Co-Operative League of America, 2 West Thirteenth street, New York.

Railway Mechanical Engineer

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with which the AMERICAN ENGINEER *was incorporated*)

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WE GUARANTEE that of this issue 10,600 copies were printed; that of these 10,600 copies, 9,766 were mailed to regular paid subscribers, 13 were provided for counter and news company sales, 259 were mailed to advertisers, 32 were mailed to employees and correspondents, and 530 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 94,650, an average of 11,831 copies a month.

THE RAILWAY MECHANICAL ENGINEER is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.).

It has been estimated that the value of the total output of machine tools in Great Britain during 1919 was about £10,000,000.

Employees in the machine and car shops on the Santa Fe system have agreed to work nine hours per day, instead of eight, beginning July 19, until the shortage of equipment is overcome.

The Chicago, Milwaukee & St. Paul car repair shops at Milwaukee, Wis., were destroyed by fire on July 18. The building was 600 ft. by 1,500 ft. and the estimated loss is $250,000. More than 100 freight cars were also destroyed.

A request of Cincinnati machine tool builders that Chinese students be admitted to this country to learn the machine tool trade has, it is understood, been refused by Louis F. Post, assistant secretary of the Department of Labor. The decision not to admit the Chinese was made by Mr. Post on a strict interpretation of the word "student."

The Speedograph locomotive recording chart shown on page 489 of the July *Railway Mechanical Engineer* was erroneously stated to cover a period of four hours, instead of two hours as is really the case. The recording tape is calibrated in minutes and there are 120 of the smallest divisions, making a total of 120 minutes or two hours.

While the Illinois Central had a number of cars of the compartment type like those found generally in Europe in the Chicago suburban service, it is learned that 50 new steel coaches now being built for that company's suburban service have end doors only. These cars are being so constructed as to be available for conversion to electrical operation when the company's electrification scheme is completed.

The board of directors of the Manila Railroad Company, which operates 647 miles of track in the Philippine Islands, nearly all on the island of Luzon, has authorized the expenditure of $2,500,000 for new equipment and betterments. The directors approved requisitions for 30 new locomotives, 100 thirty-ton freight cars and 25 additional passenger coaches. Bids for furnishing this equipment will be opened soon in New York.

The decennial celebration of the establishment of the United States Forest Products Laboratory at Madison, Wis., was held in that city on July 22 and 23, at which time an opportunity was offered to make a detailed inspection of the laboratory and of the work which it is doing. A program was also presented at which the work of the laboratory was reviewed and conferences held to promote the interests of forestry in this country.

Cable advices from Tokyo, under date of July 7, received in banking sources in New York say that a bill has been introduced by government in the Japanese Parliament creating the Imperial Electric Railway Company. The aim of the bill is to establish electrical power supply for railroads and to gradually convert steam railroads to electric. Capital will be 100,000,000 yen ($50,000,000), of which one-half will be invested by the government.

During the month of May 152 locomotives were exported, valued at $5,906,046. From the standpoint of value this represents the greatest export of locomotives for any month this year to date. The exports of freight cars in May totaled 1,884, valued at $3,789,237; passenger cars 14, valued at $110,798, and car parts $1,828,373. Car wheels and axles to the amount of $756,027 were exported during the month, compared with $593,394 in April.

At a meeting recently of representatives of all German railroad employees, with the exception of the Bavarians, it was decided to found a union of all employees. Already 350,000 members belong to this new organization. The resolution giving the board of directors the power to proclaim general strike in case of need is of special importance. Instead of sixty and more professional unions which are in existence now, the statutes of the new union allow for only nine professional organizations.

A home for boys who are taking courses in training in the apprentice department and live out of town has been started by the Brown & Sharpe Manufacturing Company, Providence, R. I. It is known as the Apprentice House and consists of a well-built three-story house located in a good residential section of Providence, a short distance from the works of the company and provides accommodation for 27 boys. It is the policy to maintain a thoroughly homelike atmosphere and to avoid any of the institutional tendencies often found in places of this kind. The house is provided with modern improvements in every way and is furnished with an aim toward comfort and a homelike environment.

The American Locomotive Company has perfected arrangements for teaching its alien employees the English language and for inducing such employees to become familiar with American ideals and to become citizens. Following the plans in effect in several other industrial plants, the classes in English for the men will take place afternoons, directly after working hours. Competent instructors will be placed in charge. The method of teaching will be similar to that employed in the General Electric Company, without using any foreign language and not using interpreters. Foundations for the language are laid in simple English phrases which the men encounter in their work every day. In one day seven men took the first steps toward citizenship.

The Western Electric Company has arranged with Columbia University, New York City, for post graduate courses for the technical men in its employ. The courses are limited to the members of the engineering department, where more than 3,000 technical men are eligible to take advantage of the offer. The hours of work in the engineering department have been especially arranged to provide those who attend the classes full opportunity for study. After the candidates are nominated by the officers of their department they must meet the academic qualifications of the University. A special course of training in technical work has also been started by the company, to instruct graduates of non-engineering colleges. The entire course takes nine months. Outside reading and lectures are required during that period.

A piston valve of the air pump of the Westinghouse brake on an English engine broke recently, says the Engineer, London. The locomotive was coupled to a passenger train, and when the fracture was discovered the driver had four miles to run, one stop to make, and the important junctions approaching the central station to be run through, and the stop in the station to be made. Besides the one stop the train had to be checked thrice and each of these occasions reduced the pressure. The train would probably have arrived safely, but at the last moment the driver thought he would not stop in time. He therefore reversed his engine, but this caused the engine wheels to lock and the train consequently ran into the buffers. Thanks to the hydraulic buffers, there was no material damage and little personal injury.

Winners in the Prize Story Contest

As the judges in the prize story contest felt that the relative merits of the stories could not be judged with fairness until after all had been published, their decision was reserved until this time. The last story was published in the July issue. Each of the judges has rated all the stories submitted.

The first prize of $75 has been awarded to Hugh K. Christie, whose story, Fools Rush in Where Angels Fear to Tread, appeared in the February issue. The second prize of $50 was won by E. F. Jones, author of the story in the June issue, How the Master Mechanic Increased Production. Andrew J. Fenton received the third prize of $25 for his story, How Jim Dugan Finally Won a "Real" Job, published in the January issue.

Co-Operative Course in Electrical Engineering

For the past year an interesting experiment in co-operative engineering education has been conducted by the Massachusetts Institute of Technology and the General Electric Company and several departures from the usual plan which were introduced have shown decided results. The class was limited to 30 students, who were chosen entirely on the records which they had made in the equivalent of the first two years' work of the electrical engineering course at Technology. The year is divided into four three-month periods, the students spending alternately 13 weeks at the Lynn works of the General Electric Company and 11 weeks at the Institute, followed by a two weeks' vacation. The group at Lynn is housed together in a residence which has been converted into a modern club house. No break is made in the major studies when the students are at Lynn, courses being conducted at the works in principles of electrical engineering and in general studies. The progress of the students through the plant is regulated, not by the production needs of the various departments, but by the advantage which the experience in each department is to the student. As evidence of its approval of the work, the company has increased the number of men who can be enrolled in this year's class to 60 and has already secured a new club house in order to furnish rooming accommodations for them.

MEETINGS AND CONVENTIONS

Chief Interchange Car Inspectors' and Car Foremen's Association.—The annual convention of this association will be held at the Windsor Hotel, Montreal, Que., September 14 to 16, inclusive.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD ASSOCIATION, SECTION III—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

AMERICAN RAILROAD ASSOCIATION, SECTION VI.—PURCHASES AND STORES.—J. P. Murphy, N. Y. C., Collinwood, Ohio.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. B. Baker, Terminal Railroad, St. Louis, Mo.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, 1145 E. Marquette Road, Chicago. Convention September 1-3, Hotel Sherman, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.— C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

AMERICAN STEEL TREATERS' SOCIETY.—W. H. Eisenman, 154 E. Erie St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

CANADIAN RAILWAY CLUB.—W. A. Booth, 131 Charron St., Montreal, Que. Meetings second Tuesday in month. except June, July and August.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 North Pine Ave., Chicago. Meetings second Monday in month, except June, July and August, Hotel Morrison, Chicago.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, secretary, Federal Reserve Bank Building, St. Louis, Mo. Meetings first Tuesday in month at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Meetings second Friday in January, March, May and September and second Thursday in November, Hotel Statler, Buffalo, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—J. C. Keene, Decatur, Ill. Convention, September 14-16, Windsor Hotel, Montreal, Que.

CINCINNATI RAILWAY CLUB.—H. Boutet, 101 Carew Building, Cincinnati, Ohio. Meetings second Tuesday in February, May, September and November.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, B. & O., Lima, O. Convention August 17-19, Hotel Statler, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 702 East 51st St., Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn. Convention Sept. 7-10, 1920, Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION OF U. S. AND CANADA.—A. P. Dane, B & M., Reading, Mass. Convention September 14-16, New American House, Boston, Mass.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Meetings second Tuesday in month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York. Meetings third Friday in month, except June, July and August, 29 W. 39th St., New York.

NIAGARA FRONTIER CAR MENS' ASSOCIATION.—George A. J. Hochgrebe, 623 Brisbane Building, Buffalo, N. Y. Meetings third Wednesday in month, Statler Hotel, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Meetings second Thursday in month, alternately in San Francisco and Oakland.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Meetings fourth Friday in month, except June, July and August, American Club House, Pittsburgh.

ST. LOUIS RAILWAY CLUB.—J. B. Frauenthal, Union Station, St. Louis, Mo. Meetings second Friday in month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. R. R., Buffalo, N. Y. Convention September 14, Chicago.

WESTERN RAILWAY CLUB.—J. M. Byrne, 916 West 78th St., Chicago. Meetings third Monday in month, except June, July and August.

PERSONAL MENTION

GENERAL

NORMAN W. ROSE has been appointed electrical engineer of the Duluth & Iron Range, succeeding A. M. Frazee.

ROBERT MCGRAW has been appointed fuel instructor on the New York Central, with headquarters at Syracuse, N. Y.

ELMER R. LARSON, supervisor of apprentices on the Delaware, Lackawanna & Western, has been appointed special motive power inspector.

A. T. PFEIFFER has been appointed assistant superintendent of fuel and locomotive performance on the New York Central, with headquarters at New York.

J. C. BRENNAN has been appointed supervisor of fuel and locomotive performance for the first district of the New York Central, with headquarters at Utica, N. Y.

E. C. ANDERSON, acting mechanical engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, has been appointed mechanical engineer, succeeding C. B. Young.

A. B. CORBETT, division master mechanic of the Missouri, Kansas & Texas of Texas, at Denison, has been transferred in the same capacity to Greenville, Tex., succeeding H. Honaker.

C. W. WHEELER has been appointed supervisor of fuel and locomotive performance for the second district of the New York Central, with headquarters at Syracuse, N. Y., succeeding L. F. Burns.

A. J. FRIES, assistant superintendent motive power of the second district, New York Central, with headquarters at Depew, N. Y., has had his title changed to district superintendent of motive power.

J. F. HILL, master mechanic of the Wheeling & Lake Erie at Brewster, Ohio, has been promoted to superintendent of motive power and cars with the same headquarters, succeeding George Durham, resigned.

R. J. NEEDHAM, mechanical and electrical engineer on the Grand Trunk, has been appointed assistant to the general superintendent of the motive power and car departments, with headquarters at Montreal, Que.

L. F. BURNS, district supervisor of fuel economy of the New York Central at Rochester, N. Y., has been appointed master mechanic of the Syracuse division, with headquarters at East Buffalo, succeeding M. W. Hassett.

W. P. DAVIS, master mechanic of the Harlem division of the New York Central, with headquarters at Brewster, N. Y., has been transferred to the Mohawk division, with headquarters at West Albany, succeeding C. F. Parsons.

H. WANAMAKER, superintendent of shops of the New York Central at West Albany, N. Y., has been appointed district superintendent of motive power of the first district, succeeding C. H. Hogan, with headquarters at Albany.

C. H. HOGAN, district superintendent of motive power, first district, of the New York Central, with headquarters at Albany, N. Y., has been promoted to manager of the department of shop labor, with headquarters at Buffalo, N. Y.

F. S. GALLAGHER, assistant engineer in the general mechanical engineer's office of the New York Central, has been appointed engineer of rolling stock with office in New York, under B. B. Milner, engineer of rolling stock and motive power. Mr. Gallagher was born at Tecumseh, Mich., and began railroad work as a machinist apprentice. He was later employed by the Pullman Company and the Lake Shore & Michigan Southern as a draftsman, leaving the latter road to come with the New York Central as assistant engineer in the general mechanical engineer's office.

J. W. CHANDLER, district foreman on the Poteau Valley line of the Kansas City Southern, with headquarters at Heavener, Okla., has been promoted to master mechanic, with headquarters at Shreveport, La., succeeding A. D. Williams.

R. W. ANDERSON, assistant superintendent motive power of the Chicago, Milwaukee & St. Paul, Lines East, with headquarters at Milwaukee, Wis., has been appointed superintendent motive power with the same headquarters. Mr. Anderson was born on May 6, 1877, in Madison county, Iowa. He began railroad work in January, 1892, as a machinist apprentice for the Des Moines Union. In January, 1897, he went to the Chicago, Rock Island & Pacific as machinist and retained that position until May, 1903, when he was promoted to assistant roundhouse foreman. Some months later he became roundhouse foreman. He entered the employ of the Chicago, Milwaukee & St. Paul as machinist at Mitchell, S. D., in September, 1904, and in November, 1905, was appointed assistant roundhouse foreman at the same place. He was transferred as machinist to the Idaho division in September, 1907, and in June of the following year was promoted to mechanical foreman of the same division. From May, 1908, until August, 1911, he served as roundhouse foreman at Avery, Idaho. He was then transferred to Miles City, Mont., and while there was appointed district master mechanic in November, 1912. He retained that position until June, 1918, when he was promoted to assistant superintendent motive power, as mentioned above.

R. W. Anderson

C. B. YOUNG, who was recently reappointed mechanical engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, as noted in these columns last month, has been promoted to general mechanical engineer, with the same headquarters.

L. K. SILLCOX, recently appointed assistant general superintendent motive power of the Chicago, Milwaukee & St. Paul, has now been appointed general superintendent motive power, with headquarters at Milwaukee, Wis., succeeding H. R. Warnock.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

J. H. HENLEY, master mechanic of the Missouri, Kansas & Texas at Parsons, Kan., has been appointed road foreman of engines and will have his headquarters at Muskogee, Okla.

C. F. PARSONS, master mechanic of the New York Central at West Albany, N. Y., has been appointed general master mechanic of the first district, with headquarters at Albany.

A. D. WILLIAMS has been appointed master mechanic of the Texarkana & Fort Smith, with headquarters at Texarkana, Tex., succeeding F. M. Hill assigned to other duties.

M. W. HASSETT, master mechanic of the New York Central at East Buffalo, N. Y., has been appointed general master mechanic of the second district, with the same headquarters.

W. H. ECKROATE, road foreman of engines of the Wheeling & Lake Erie at Brewster, Ohio, has been appointed master mechanic, succeeding J. F. Hill, with the same headquarters.

J. J. MELLEY, master mechanic of the Missouri, Kansas & Texas, of Texas, at Wichita Falls, Tex., has been transferred to Parsons, Kan., succeeding J. H. Henley as master mechanic there.

A. J. LEWIS, shop superintendent of the Missouri, Kansas & Texas of Texas, at Denison, has been appointed division master mechanic, with the same headquarters, succeeding A. B. Corbett.

H. HONAKER, master mechanic of the Missouri, Kansas & Texas of Texas, with headquarters at Greenville, Tex., has been transferred in the same capacity to Wichita Falls, Tex., succeeding J. J. Melley.

A. T. HEINTZ, assistant master mechanic of the Mohawk division of the New York Central at West Albany, N. Y. has been appointed master mechanic of the Harlem division, with headquarters at Brewster, N. Y., succeeding W. P. Davis.

CAR DEPARTMENT

J. H. DOUGLAS, general shop foreman of the Wheeling & Lake Erie at Ironville, Ohio, has been promoted to master car builder, with headquarters at Brewster, Ohio.

A. J. WILLIAMS, assistant road foreman of engines on the Maryland division of the Pennsylvania, has been appointed general air brake and steam heat inspector on the Southern division.

CHARLES I. WALKER, whose promotion to master car repairer of the Southern Pacific, with headquarters at Los Angeles, Cal., was announced in these columns last month, was born on December 3, 1875, at Hillsboro, Mo. Mr. Walker entered railway service as an apprentice car builder with the St. Louis, Iron Mountain & Southern on July 27, 1891, and during the next seven years served in several branches of this department. In June, 1898, he entered the service of the Mexican National, with headquarters at Laredo, Tex., as a car builder. In September, 1898, he went with the St. Charles Car Company at St. Charles, Mo., and in August, 1900, with the Pullman Company at Chicago, where he was later promoted to assistant foreman. In July, 1904, he returned to the Mexican National at Laredo, and on February 1, 1905, he was promoted to master car builder on that system. He was appointed foreman in the passenger repair department of the Cincinnati, Hamilton & Dayton, with headquarters at Lima, O., in July, 1906. In October 1907, he became a shop foreman on the Southern Pacific, and shortly thereafter was appointed draftsman. After a short service as inspector, he was transferred, in May, 1919, to the general freight car department at San Francisco, Cal., where he was located at the time of his recent promotion.

SHOP AND ENGINEHOUSE

D. JOHNSON has been appointed general foreman of the Erie at Marion, Ohio, succeeding R. M. Wilson, transferred.

H. SCHMIDT has been appointed roundhouse foreman of the Erie at Cleveland, Ohio, succeeding F. C. Hunter, transferred.

J. B. FRASER has been appointed shop foreman of the Canadian National at Saskatoon, Sask., succeeding A. D. McMillan, resigned.

B. C. NICHOLSON has been appointed shop superintendent at Denison, Tex., of the Missouri, Kansas & Texas of Texas, succeeding A. J. Lewis.

S. J. DILLON, enginehouse foreman of the Pennsylvania at Atlantic City, N. J., has been appointed shop inspector on the New Jersey division.

ENOCH HEWITT, general foreman of the Pennsylvania shops at Meadows, N. J., has been appointed enginehouse foreman at Atlantic City, succeeding S. J. Dillon.

JOHN MURRAY, assistant supervisor of apprentices on the Delaware, Lackawanna & Western, has been promoted to supervisor of apprentices, succeeding Elmer R. Larson.

J. G. PARSONS, superintendent of shops of the New York Central at Depew, N. Y., has been transferred to West Albany as superintendent of shops, succeeding H. Wanamaker.

J. C. LAPORT, enginehouse foreman of the Pennsylvania at Coalport, has been appointed general foreman of the Meadows shops, Meadows, N. J., succeeding Enoch Hewitt.

B. F. SHONE, general foreman of the locomotive department of the New York Central at Depew, N. Y., has been appointed superintendent of shops there, succeeding J. G. Parsons.

PURCHASING AND STOREKEEPING

DANIEL W. ROBERTS, division storekeeper of the Union Pacific at Kansas City, Mo., has been appointed general storekeeper of the Pere Marquette, with headquarters at Detroit, Mich. Mr. Roberts was in the service of the Union Pacific continuously since 1906, having entered the employ of that road as a call boy at Cheyenne, Wyo. In 1909 he was appointed storekeeper at Cheyenne, being transferred to Omaha, Neb., in 1911 and to North Platte, Neb., in 1913. In 1915 he returned to Cheyenne as division storekeeper and in 1917 went to Denver, Colo., in the same capacity. He was transferred to Kansas City in 1918, and held the position of division storekeeper there until he recently resigned it to accept his present one as general storekeeper of the Pere Marquette.

D. W. Roberts

E. H. HUGHES has been appointed general storekeeper of the Kansas City Southern, with headquarters at Pittsburgh, Kans., succeeding R. C. Lowry, resigned.

OBITUARY

BENJAMIN F. SARVER, boilermaker foreman of the Pennsylvania at Fort Wayne, Ind., died of heart disease on July 23 at a hospital in Chicago. Mr. Sarver was a member of the executive board of the Master Boiler Makers' Association and was one of its earliest members.

SUPPLY TRADE NOTES

James L. Gough, president of the Federal Machinery Sales Company, Chicago, has retired from active business.

Frank J. Farrell has been appointed eastern representative of the Precision & Thread Grinder Manufacturing Company, Philadelphia, Pa.

Clark T. Dickerman, sales agent for the American Car & Foundry Company, with headquarters at New York, has been transferred to the Chicago office.

B. M. Jones & Co., Inc., New York, distributors for Double Mushet high speed steel and Taylor's Best Yorkshire iron, announce that they are now being represented in the southeastern territory by the W. S. Murrian Company, 605 Fourth street, Knoxville, Tenn. W. S. Murrian for a number of years was connected with the mechanical department of the Southern Railway, but during the war period he was associated with the United States Railroad Administration, Railway Board of Adjustment No. 2. His son, John H. Murrian, has recently been discharged from the army, having served with the American Overseas Air Force and being the possessor of three distinguished foreign decorations.

W. S. Murrian

G. M. Calmback, welding supervisor of the Kansas City Southern, has been appointed welding advisory engineer of the Geist Manufacturing Company, Atlantic City, N. J.

Roland Whitehurst, of the New York sales office of the Electric Storage Battery Company, Philadelphia, Pa., has been appointed manager of the Washington, D. C., sales office.

T. W. McManus, master mechanic for the Kellogg Switchboard & Supply Company, Chicago, has been elected vice-president and general manager of the Security Tool Works, Chicago.

W. W. Rosser, vice-president of the T. H. Symington Company, Rochester, N. Y., has become associated with the Bradford Draft Gear Company, New York, with headquarters at Chicago.

W. L. Randall and T. D. Randall of D. W. Randall & Co., Chicago, have recently organized the Randall Foundry and will build a plant at Michigan City, Ind., for the manufacture of grey iron castings for railway equipment.

The Halcomb Steel Company, Syracuse, N. Y., announces the opening of a branch office and warehouse with a complete stock of the company's tool steel products. The New York office will be under the management of F. W. Ross.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, has opened a new office in Philadelphia, in charge of H. K. Hardcastle. It is located in the Witherspoon building, at the corner of Walnut and Juniper streets.

W. S. Quigley, president of the Quigley Furnace Specialties Company, New York, recently sailed for Europe for the purpose of furthering the business relations of the Quigley organization in England, France, Belgium, Italy and Spain.

The Refinite Company, Omaha, Neb., manufacturer of the Refinite water softener and the Refinite rapid pressure filter, has just acquired ownership and control of the L. M. Booth Company, Jersey City, N. J., manufacturer of the Booth limesoda water softener.

The Air Reduction Sales Company has just completed the construction of a new acetylene plant at 560 Broadway, Gloucester, N. J. The buildings making up this new unit consist of a gas house, carbide storage building and a generator house.

The American Car & Foundry Company has recently purchased two additional pieces of real estate for its contemplated $2,000,000 plant extending from Blue Island avenue, along Paulina street to the Chicago river, at Chicago. The land, now occupied by the company, was formerly under lease.

The general offices of the Wilson Welder & Metals Company, formerly at 2 Rector street, New York, have been moved to 253 Thirty-sixth street, Bush Terminal, Brooklyn, N. Y. The offices of the Wilson Welding Repair Company, formerly of the same address, are now at 263 First street, Jersey City, N. J.

Simon M. Dolan has been elected vice-president of the G. F. Cotter Supply Company, Houston, Tex. He began railway work with the Baltimore & Ohio as a boilermaker apprentice at Garrett, Ind. Two years later he was made a machinist apprentice, and subsequently served on various railroads and in industries as a machinist and for a short time as a locomotive fireman. From 1894 to 1902, he was with the Wiggins Ferry Company, St. Louis, consecutively as general foreman, master mechanic and superintendent, and also served as master mechanic on other railroads. He subsequently went to the Southern Railway as general mechanical inspector, and later was master mechanic. In 1905 he went to the Missouri Pacific as a master mechanic at Little Rock, Ark., and later served in the shops at Sedalia, Mo. In 1908 he entered the service of the Scullin Steel Company in its steel plant and later was sales agent and assistant to the vice-president in charge of sales, respectively. He was sales agent for the American Car & Foundry Company, St. Louis, in 1911, and four years later went with the Chicago Varnish Company, resigning recently from the position of western and southwestern representative of its railroad department to become vice-president of the G. F. Cotter Supply Company.

S. M. Dolan

Alfred Herbert, Ltd., machine tool makers and importers, Coventry, England, announce that E. D. Mitchell, for many years a member of the Coventry staff, and lately assistant manager of the New York branch, has been appointed man-

ager at New York, to succeed W. J. Fuller, who has resigned from that position.

B. B. Milner, now engineer of motive power and rolling stock of New York Central, has completed arrangements for becoming associated with the Oriental organization of Frazar & Co., 30 Church street, New York, and will sail for his new headquarters in the Tokio, Japan, offices of Sale & Frazar, Ltd., some time this fall.

The New York Air Brake Company, New York, has opened an office in room 1405, Walker Bank building, Salt Lake City, Utah, which will be the headquarters for Captain Thomas O'Leary, Jr., representative. Captain O'Leary has acted as representative of the company in western territory since his return from France.

F. V. Green, who left the service of the Westinghouse Air Brake Company some time ago to become associated with the Baldwin Locomotive Works, has now opened his office in the Standard Bank building, Johannesburg, South Africa. Mr. Green is export manager for the Baldwin Locomotive Works, in charge of South African territory.

Albert G. Elvin, who has been elected vice-president in charge of operation and treasurer of the Elvin Mechanical Stoker Company, New York, as was announced in the July issue, was born on February 26, 1865, at North Vernon, Ind., and was educated in the public schools. He began railway work in 1881, serving as boilermaker and machinist apprentice at Peru, Ind., on the Indianapolis, Peru & Chicago. In 1889 he went to the Pittsburgh, Cincinnati, Chicago & St. Louis at Indianapolis as a machinist and in 1890, was put in charge of the tool shop, manufacturing all tools for the entire system. He was later general foreman on the Chesapeake & Ohio at Clifton Forge, Va., master mechanic on the Grand Trunk, Montreal, Que., and in January, 1901, he was appointed general master mechanic on the Delaware, Lackawanna & Western at Scranton, Pa. During this time he designed and put into operation many labor-saving devices. Among these, in 1896, he introduced the first pneumatically operated turntables and transfer tables in this country. In 1902 he invented and patented the Elvin driving box lubricator, which is known today as the Franklin driving box lubricator and has been standard on the majority of locomotives in the United States and Canada for the past 14 years. In 1903 he went to the Franklin Railway Supply Company, then known as the Coffin-Megeath Supply Company, and remained with the company as mechanical manager until 1916, when he retired from active work due to a breakdown in health. During the time he was associated with the Franklin Railway Supply Company he invented and patented a pneumatic firedoor, and the steam grate shaker. The latest of his devices is the Elvin mechanical stoker, which has been in successful service for the past three years on the Erie Railroad.

A. G. Elvin

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, announces that the Minnesota Supply Company, 802 Pioneer building, St. Paul, Minn., has been appointed its northwest sales representative. The business is in charge of W. H. Hooper, who has been engaged in railway work and the railway supply field for the past 25 years.

The extensive improvements contemplated by the Pollak Steel Company, Cincinnati, Ohio, for its rolling mill at Marion, Ohio, some time ago, are now in the course of actual construction. The improvements consist of several new buildings, equipment, etc. The products of this plant consist of rolled steel bars and shapes, concrete reinforcing bars, etc.

The Clark-Mesker Company, Cleveland, Ohio, was recently incorporated for the purpose of taking over the machine tool department of the Cleveland Milling Machine Company. The officers of the new company are as follows: D. B. Clark, president; L. H. Mesker, vice-president and general manager, and Charles A. Morris, secretary and treasurer.

The Imperial Japanese government has conferred the Fourth Class of the Imperial Order of Mediji upon Charles M. Muchnic, vice-president of the American Locomotive Sales Corporation, New York, and invested him with the insignia of the Imperial Order of the Rising Sun pertaining to said class, in expression of the good will which it entertains towards him.

R. T. Hazelton has been appointed works manager, in complete charge of production, of the Cincinnati Shaper Company, Cincinnati, Ohio, and will also act in this capacity for the Cincinnati Gear Cutting Machine Company, a subsidiary of the Cincinnati Shaper Company. Mr. Hazelton was formerly superintendent and chief engineer of the Cincinnati Milling Machine Company.

The Burden Iron Company, Troy, N. Y., has entered into a contract for a term of years with the Burden Iron Company Railroad and Steamship Division, to dispose of its products as applied to railroad and steamship companies. Edward L. Smith is the general partner of this newly organized partnership, and W. J. Caton has been appointed secretary, with office at 3711 Grand Central Terminal, New York.

The Worthington Pump & Machinery Corporation, New York, announces the purchase from the Platt Iron Works, Dayton, Ohio, of its drawings, patterns, jigs, templates, special tools, good-will and name, on its following lines of product: Oil mill machinery, hydraulic turbines and water wheels, feed water heaters and high pressure air compressors for torpedo and other high pressure charging, cleaning and discharging.

T. D. Slingman has joined the sales organization of the Keller Pneumatic Tool Company, Grand Haven, Mich., as special representative, with headquarters at its Pittsburgh office. Mr. Slingman has for many years been identified with the selling organization of the Chicago Pneumatic Tool Company, for the past nine years as district manager at Detroit. He left the service of that company on June 1 and shortly thereafter joined the Keller force.

The drop forging business and plants of the Whitman & Barnes Manufacturing Company at Chicago and St. Catharines, Ont., have been combined with the J. H. Williams & Co., Brooklyn, and will be operated by this company. The organization will include the individuals heretofore identified with both businesses. The business of the Whitman & Barnes Manufacturing Company, Akron, Ohio, will be confined to the manufacture of twist drills and reamers.

Edward A. Schreiber, general manager of the Vapor Car Heating Company, Railway Exchange building, Chicago, died on July 4 from heart trouble, following a previous at-

tack on May 20, just after his return from a European trip in the interest of the car heating company. Mr. Schreiber was formerly connected with the steam fitting department at the Pullman car works, and in 1901, entered the service of the Chicago Car Heating Company, predecessor of the present Vapor Car Heating Company, since which time, and up to his death at the age of 58, he was active in the affairs of that company.

L. E. Summers has been appointed works manager of the Keller Pneumatic Tool Company's factory at Grand Haven, Mich. Mr. Summers is one of the pioneers in the mechanical department of the pneumatic tool industry, having started his career in 1894 with Joseph Boyer, St. Louis. He then went to the Boyer plant of the Chicago Pneumatic Tool Company, at Detroit, where he was assistant manager for nine years, and then he was works manager for eight years. He resigned in 1918, since which time he has been employed by various interests on the Pacific Coast, until he joined the Keller organization on June 1 of this year.

The Milwaukee Electric Railway & Light Company, after more than two years of continued use of pulverized coal under five boilers in the Oneida street plant, has decided to use this form of fuel in the new Lakeside power plant. The installation will consist of eight 1,306-hp. Edgemoor water tube boilers. The contract for the drying, pulverizing and transportation equipment has been placed with the Fuller Engineering Company, Allentown, Pa. The feeders and burners will be furnished by the Locomotive Pulverized Fuel Company, New York. Lopulco duplex feeders with five-inch screws will be used and three Lopulco burners will be installed in each boiler. The feeders will be driven by Morse silent chain and the Reeves type variable speed mechanism.

Charles P. King, formerly manager of the New York office of the Lima Locomotive Works, Inc., and who for several years previously traveled in the West Indies and Central and South American countries for the same corporation, on July 15 assumed charge of the car business of the Ralston Steel Car Company, Columbus, Ohio, as eastern sales and export representative at the offices of the Ralston Car Sales Corporation, the selling agent for the Ralston Steel Car Company, 2 Rector street, New York. Mr. King received his preliminary training in the car building business in the shops and offices of the old Jackson & Sharp Car Company, Wilmington, Del., under the direction of his father, A. M. King, who was, for many years, until his death in 1897, general superintendent of that company. Mr. King returns to the railroad field after a brief venture in the export trade-paper publishing business.

Harry R. Warnock, general superintendent of motive power of the Chicago, Milwaukee & St. Paul, has become associated with the Standard Stoker Company, New York, as vice-president in charge of the mechanical department, with headquarters at New York. Mr. Warnock was born at Newcastle, Pa., on July 16, 1870. He began railway work as a freight brakeman with the Pennsylvania Lines West of Pittsburgh in June, 1889. He later worked as a brakeman, locomotive fireman and engineman on the Pittsburgh & Lake Erie until May, 1900. From that date until July, 1904, he served consecutively as engine dispatcher, roundhouse foreman, and general foreman, resigning from that position to become master mechanic of the West Side Belt, Pittsburgh, Pa., where he remained until October, 1905, when he became master mechanic of the Monongahela Railroad. He remained in this position until September, 1913, when he was appointed superintendent of motive power of the Western Maryland, and on December 15, 1917, was appointed general superintendent of motive power of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago.

TRADE PUBLICATIONS

Oil Separator.—The Griscom-Russell Company, New York, describes the construction of the Bundy oil separator in a 12-page bulletin, No. 1130. This separator is designed for the removal of oil from exhaust steam in power plants. Sectional views and drawings make the construction and operation clear and instructions are given for cleaning.

Twist Drills and Reamers.—The Whitman & Barnes Manufacturing Company, Akron, Ohio, which is now manufacturing twist drills and reamers exclusively, has revised its catalogue to cover only these products. It contains 120 pages, giving prices and all necessary data. In the back of the book are tables of tap drill sizes, decimal equivalents of regular sizes, cutting feeds and speeds, etc.

Pneumatic Tools and Electric Drills.—The Independent Pneumatic Tool Company, Chicago, has revised its catalogue of Thor tools. The new book contains 78 pages, giving descriptions, illustrations, dimensions and sizes, and covers the new additions to the line, consisting of motor driven air hoists, pneumatic sand rammers, universal vise for pneumatic drills, hose coupling, power screw driver, hose clamp and hose mender.

Feedwater Heating.—Figures showing the amounts that may be saved on coal bills by preheating feedwater with the heater developed by the Locomotive Feed Water Heater Company, New York, are contained in bulletin No. 6, issued by that company. The savings are also presented graphically on a chart which is arranged to show the monthly saving per locomotive for any combination of fuel consumption and gross ton miles per month and for varying coal costs.

Automatic Train Line Connectors.—The Robinson Connector Company, New York, has recently issued a 23 page booklet illustrating the advantages and method of operation of the Robinson connector. Attention is called to the simplicity of the connector and its automatic features. Clear cut illustrations show how the connector is applied to the draw bar and a view is shown of the shop in which connector parts are made. The booklet is well illustrated and carefully written.

Driving Box Wedge.—The operation and construction of the Franklin automatic adjustable driving box wedge, which is claimed to maintain wedge adjustment under all conditions and increase the life of crown bearings and rod bushings, is described fully in a four-page pamphlet, bulletin No. 601, distributed by the Franklin Railway Supply Company, New York. Instructions are also given for applying the wedge on new and existing power and a drawing is included showing its proportions and the space that should be provided for wedges when designing new engines.

Die Heads.—The Eastern Machine Screw Corporation, New Haven, Conn., has compiled a 96-page catalogue covering H & G automatic self-opening die heads and collapsible taps, and in addition includes much valuable data relating to thread cutting that should be useful to men working out threading problems. The descriptions are concise and are well illustrated. They cover four types of die heads, a new H & G collapsible tap and chasers for the die heads. Detailed instructions for opening the heads, installing chasers, closing the heads and adjusting the pitch diameter, with information on cutting speeds and lubricants, is also included.